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Structure and Performance of the Services Sector in Transition Economies

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Abstract

This paper examines the structure and performance of the services sector in Eastern European and Central Asian countries during 1997-2004. Services represent an increasing share of total value added and employment with the major sub-sectors being wholesale trade, retail trade, inland transport, telecommunications, and real estate activities. A clear divide separates EU-5 countries from South Eastern European countries and Ukraine in terms of services labor productivity. Although a large gap in productivity also separates EU-8 countries from EU-15 countries, that gap was reduced from 1997 to 2004 as most services sub-sectors experienced fast productivity growth. High skill intensive sub-sectors and information and communications technology producers and users have exhibited higher productivity levels and growth rates relative to other sub-sectors since 2000. The author finds a positive effect of services liberalization on the productivity growth of services sub-sectors. The author also finds a positive and significant effect of services liberalization in both finance and infrastructure on the productivity of downstream manufacturing.

This paper—a product of the Trade Team, Development Research Group—is part of a larger effort in the department to examine the effect of trade in services on developing countries. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at afernandes@worldbank.org.

Structure and Performance of the Services Sector in Transition Economies

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1. Introduction

Growth in the services sector and a decline in the agricultural sector are structural features of economic development (Chenery and Taylor, 1968). In OECD countries, the services sector represents more than two-thirds of economic activity. In Eastern European and Central Asian (ECA) countries, the importance of the services sector for GDP and employment has substantially increased since the beginning of transition and accounts presently for more than half of the economic activity in those countries (World Bank, 2006). Prospects for future growth in the ECA region depend to a large extent on a more efficient and more dynamic services sector.

An efficient services sector has direct consequences for economic growth. Anos-Casero (2007) shows that the recent sectoral shift towards services has contributed to an increase in aggregate productivity in the ECA region. An efficient services sector also has indirect consequences for economic growth through the efficiency of other sectors in the economy. High-quality services such as transport or telecommunications affect production costs and consequently the competitiveness and the degree of integration into global markets of firms in all sectors. Moreover, high-quality services can also influence the attractiveness of a location for foreign direct investment (FDI). Recent work by Eschenbach and Felix (2006) shows that indeed ECA countries which have achieved more progress in services sector policy reforms aimed at increasing efficiency since 1990 have attracted more FDI and exhibit faster per capita GDP growth.

In this paper, we examine the structure and performance of the services sector in ECA countries and we investigate the effect of policy reforms in the services sector on the performance of the downstream manufacturing sector between 1997 and 2004. In the analysis we consider, depending on data availability, either the group of EU-5 countries plus South Eastern European countries (Bulgaria, Croatia, Macedonia, Romania, Serbia and Montenegro) plus Ukraine and Russia, or EU-8 countries, or a combination of countries from both groups.[1] During 1997-2004, services represent an increasing share of total value added and employment in the ECA region, averaging 46% and 31%,

[1] EU-5 countries are the Eastern European non-Baltic countries that joined the European Union on January 1st 2004: the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia. EU-8 countries are EU-5 countries plus the Baltic countries - Estonia, Latvia, and Lithuania - that also joined the European Union on January 1st 2004.

respectively. These percentages are not too distant from those in EU-15 countries, which is remarkable given the under-development of the services sector at the beginning of transition due to the primacy given to the manufacturing and agricultural sectors during the communist period.[2]

Our main findings are as follows. First, there is substantial variation in labor productivity of services across ECA countries. A clear divide separates the substantially more productive EU-5 countries from the South Eastern European countries and Ukraine. We also find a large gap in services productivity between EU-8 countries and EU-15 countries. The average labor productivity of the best EU-8 performer Hungary is about 71%, while that of the worst EU-8 performer Lithuania is only 26%, of the average labor productivity in EU-15 countries. However, this productivity gap is reduced between 1997 and 2004. Second, for all services sub-sectors there are large disparities in labor productivity across ECA countries. Different countries have a 'comparative advantage' in different sub-sectors: e.g., Poland exhibits the highest productivity in wholesale, retail, and repair of motor vehicles while Ukraine exhibits the lowest labor productivity in most sub-sectors. Third, while most services sub-sectors are characterized by strong productivity growth between 1997 and 2004, we find large disparities in labor productivity growth rates across countries and sub-sectors. For most sub-sectors, average labor productivity growth in EU-8 countries is actually higher than average labor productivity growth in EU-15 countries during 1997-2004 suggesting ongoing catch-up processes and a potential for services-driven growth in the ECA region. Fourth, services sub-sectors that are information and communications technology (ICT) producers or users and those that use skilled labor intensively exhibit substantially higher labor productivity levels during 1997-2004 and growth rates after 2000 in EU-8 countries. Fifth, we find evidence of higher labor productivity levels in ECA countries which have achieved more progress in services sector policy reforms, particularly for financial intermediation. We also find evidence of a positive effect of liberalization on labor productivity growth of services sub-sectors across ECA countries. Finally, we find a positive and significant effect of services liberalization on labor productivity of

[2] EU-15 countries are the European Union members prior to 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

downstream manufacturing sub-sectors considering EU-5 countries, Estonia, Lithuania, Bulgaria, and Romania. Our findings suggest that the beneficial effect of services liberalization is verified only when reforms in ***both*** essential and complementary backbone services - finance and infrastructure – occur.

The recent productivity growth rates in the services sector in ECA countries will likely lead to improvements in the efficiency of 'backbone' services such as transport, telecommunications, and finance. Such efficiency improvements are crucial for the competitiveness of other sectors in the economy and their integration into global markets, but also to enable ECA countries to participate in the global fragmentation of services production which would increase services exports. Policy-makers in ECA countries must therefore play a major role in sustaining the momentum of growth in the services sector by pursuing further services liberalization across the board, removing product market barriers still limiting competition in various sub-sectors, allowing and attracting more FDI and providing the incentives to promote trade in services. Such policies will bring growth to ECA countries and help them in closing the services productivity gap that separates them from EU-15 countries.

The paper is organized as follows. Section 2 documents the structure of the services sector in ECA countries. Section 3 examines the performance of the services sector and Section 4 focuses on the determinants of services performance in ECA countries. Section 5 investigates the effect of policy reforms in the services sector on manufacturing sector performance. Section 6 concludes.

2. Structure of the Services Sector

The services sector covers a disparate set of activities ranging from electricity generation to banking or retail trade. Services can be divided into backbone services - activities that change or add value directly to other economic units or to goods belonging to other economic units (OECD, 2003) - and services for final consumption (e.g., tourism, hairdresser). In this paper, we define services to cover the NACE 2-digit categories 40-41 and 50 to 74 listed in Appendix Table A. 1. [3] That is, we exclude from

[3] Note that in the World Development Indicators' sectoral classification, NACE 40-41 - electricity, gas, and water – are part of the 'industry' sector, which is distinct from the 'services' sector. We explicitly include NACE 40-41 in our definition of market services.

the analysis public administration and defense, compulsory social security, education, health, social work, sewage and refuse disposal, sanitation, membership organization services, recreational, cultural, or sporting services.

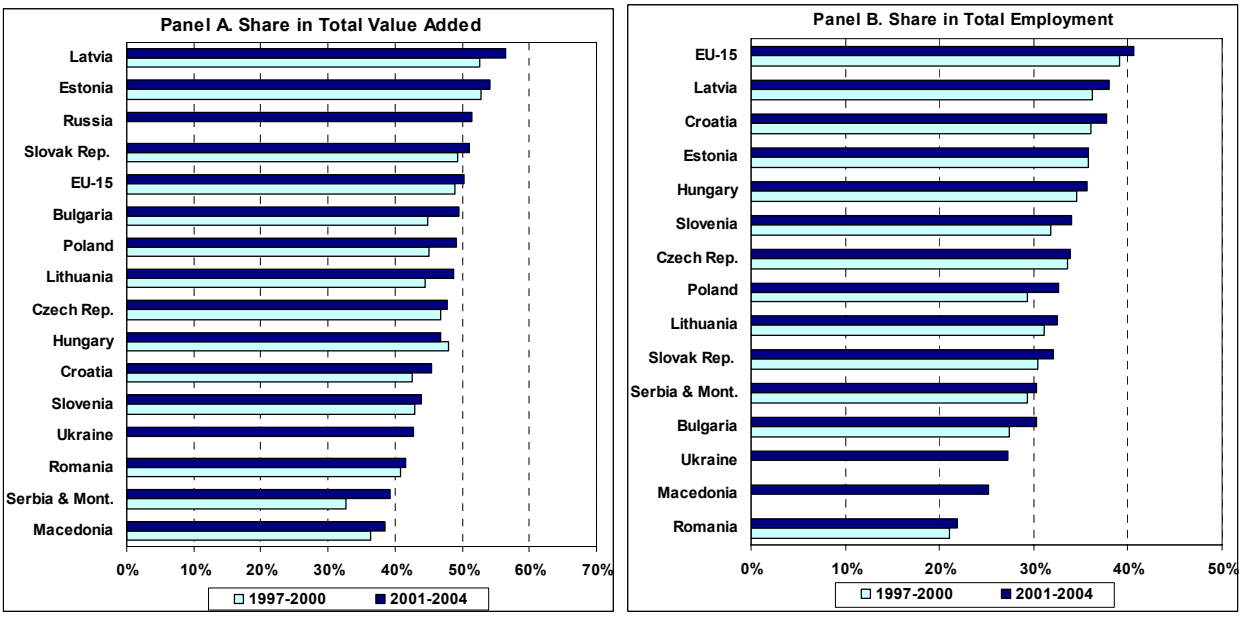
We use two data sources to cover the most recent period in the transition 1997-2004: (1) the *WIIW Handbook of Statistics 2005: Central, East, and Southeast Europe* from the Vienna Institute which covers services sub-sectors at a more aggregate level than NACE 2-digit for Bulgaria, Croatia, the Czech Republic, Hungary, Macedonia, Poland, the Slovak Republic, Slovenia, Romania, Russia, Serbia and Montenegro, and Ukraine; and (2) the *KLEMS database 2007 release* from the Groningen Growth and Development Center which covers services sub-sectors at the NACE 2-digit level for the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia (see Timmer et al., 2007). We designate the countries covered by the WIIW database as 'the group of EU-5 countries, South Eastern European countries, Russia and Ukraine' and those covered by the KLEMS database as 'EU-8 countries'. When both databases are combined, we use the term 'ECA countries' or 'ECA region'. To obtain a broad picture of recent trends in the services sector in the ECA region, it is important to cover, in addition to EU-5 countries, both South Eastern European countries and Ukraine as well as Baltic countries. Thus, we will rely on both databases in the analysis that follows (i) jointly when analyzing the importance of services in the economy and (ii) separately when analyzing labor productivity. From the WIIW database, we use for each country and sub-sector data on gross value added and employment.[4] From the KLEMS database, we use for each country and sub-sector data on gross value-added, employment, output price deflators, and purchasing power parity (PPP) conversion rates.

Figure 1 shows the share of services in total value added and employment for each country averaged in 1997-2000 and in 2001-2004, combining the WIIW and the KLEMS databases. In the ECA region, services represent on average 44.6% of total value added in 1997-2000 but that share increases substantially to 47.1% in 2001-2004. Services represent on average 31.4% of total employment in 1997-2000, increasing to 32% in 2001-2004. Interestingly, the average shares for ECA countries are not too distant from the corresponding averages in EU-15 countries also shown in Figure 1. This finding

[4] Appendix Table 2 defines all variables used in the analysis showing country and time coverage for each.

is remarkable given the under-development of the services sector at the beginning of transition due to the primacy given to the manufacturing and agricultural sectors during the communist period. In fact, services represent a higher share of value added in the Slovak Republic, Russia, Estonia and Latvia than in EU-15 countries. Figure 1 shows some differences in the importance of services across ECA countries. While in the Baltic countries, Russia, and the Slovak Republic, services represent more than 50% of value added in 2001-2004, they represent only 38.5% in Macedonia. Also, services represent about 38% of employment in Croatia and Latvia but only 21.9% in Romania. In general, services contribute higher shares to value added and employment in EU-8 countries than in other ECA countries, with Croatia being an exception in terms of employment.

Figure 1: Services Sector Share in Value Added and Employment

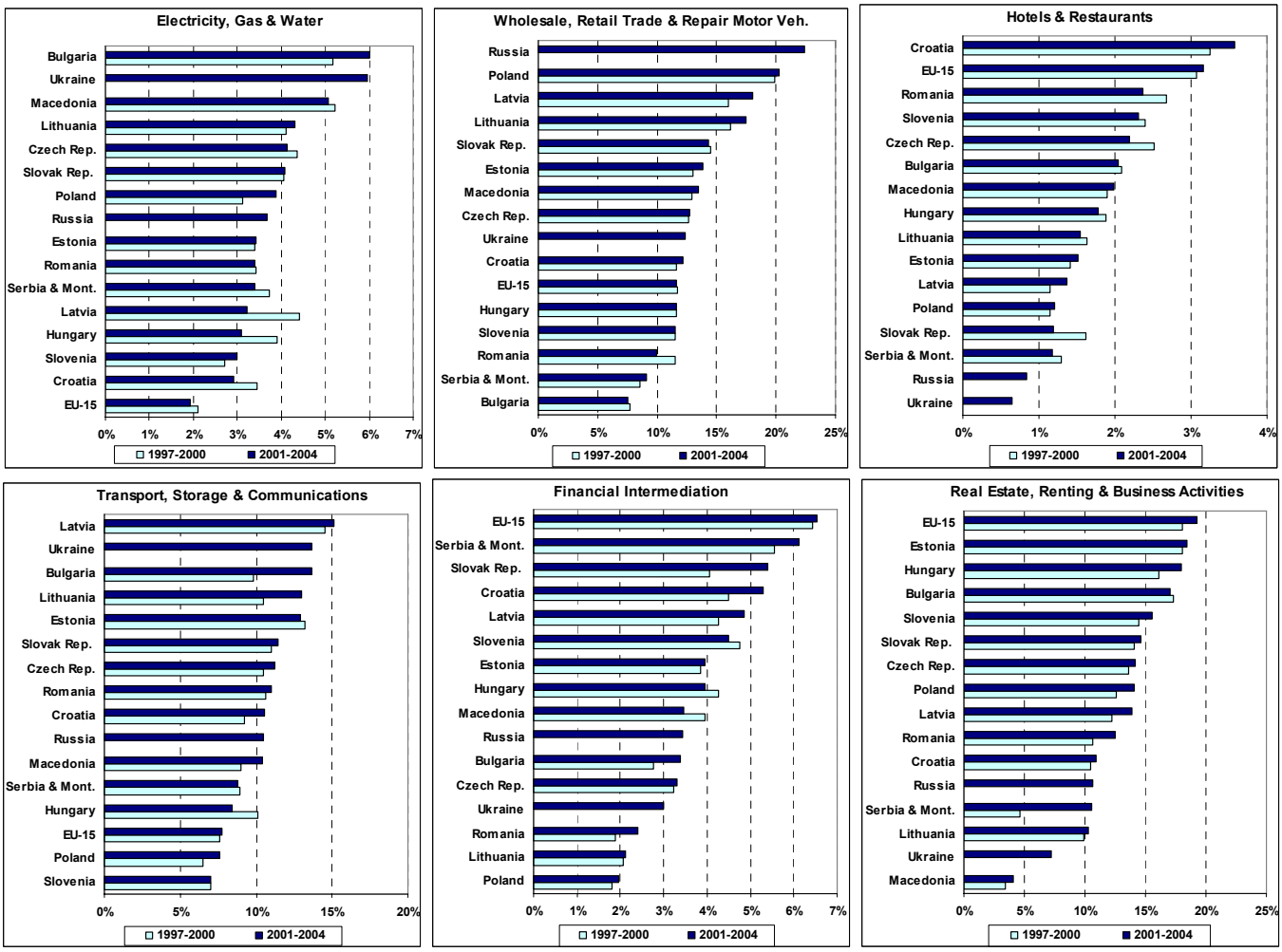


Source: WIIW database 2005 and KLEMS database 2007.
Note: The data for Baltic countries and for EU-15 countries is taken from the KLEMS database 2007.

Evidence on the importance of specific services sub-sectors across ECA countries is provided in Figures 2 and 3. Figure 2 shows the average share in total value added of each of the sub-sectors in the WIIW database in 1997-2000 and in 2001-2004. Note that a change over time in the share of a given sub-sector in value added in Figure 2 may depend on two opposing trends related to prices and quantities, which we are unable to disentangle. First, if production in a sub-sector increases by more than production in

other sub-sectors and prices are assumed to be constant, an increase in the sub-sector's share in value added at current prices will result. Second, if increased demand and more efficient production lead to a decline in relative prices, a decline of a sub-sector's share in value added at current prices will result.

Figure 2: Share of Services Sub-Sectors in Value Added



Source: WIIW database 2005 and KLEMS database 2007.
Notes: For the Baltic countries and for EU-15 countries, the NACE 2-digit sub-sectors in the KLEMS database are aggregated to match the 6 more aggregate sub-sectors in the WIIW database.

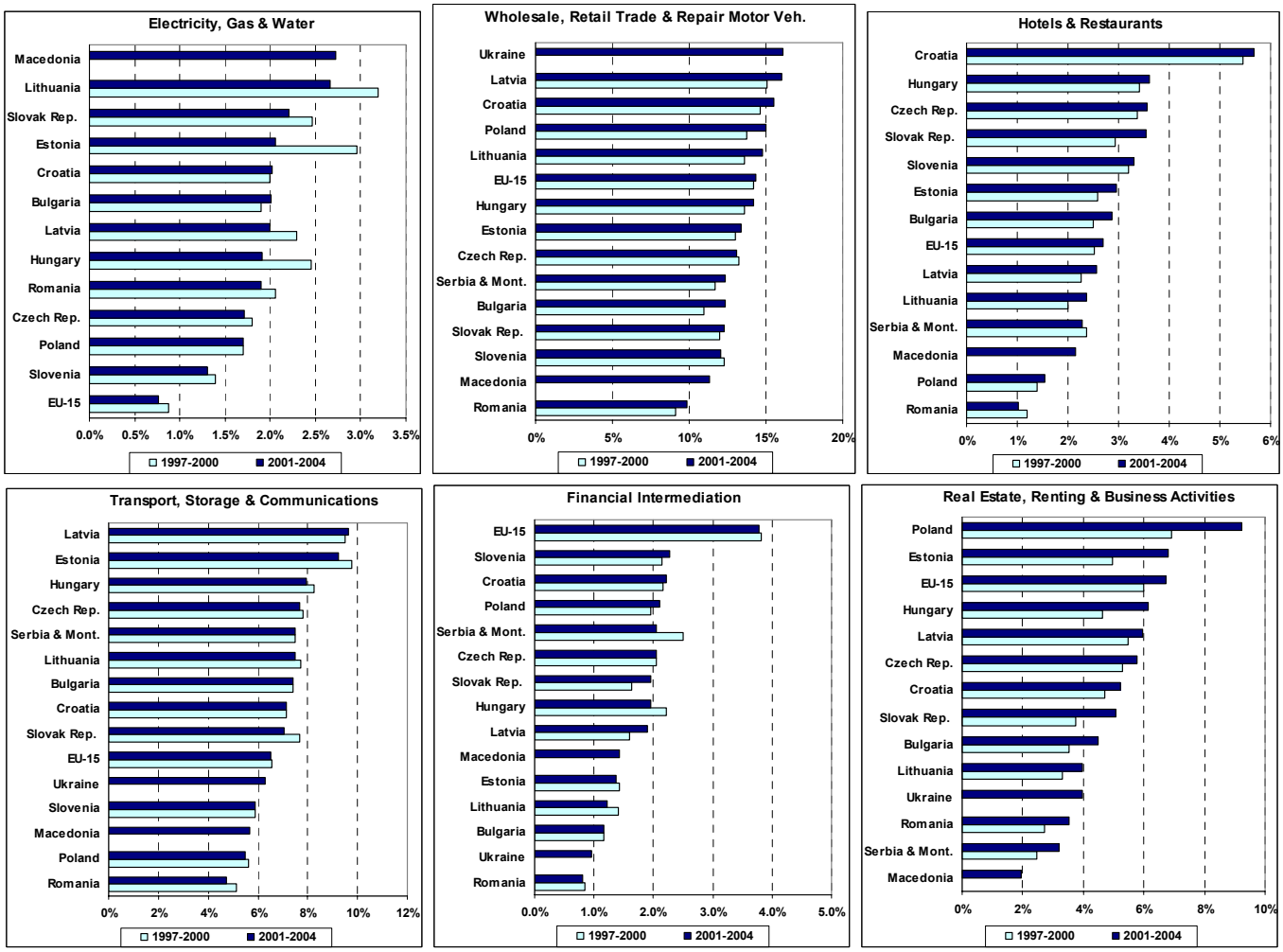
In terms of their contribution to value added, the major services sub-sectors across ECA countries between 1997 and 2004are wholesale, retail, and repair of motor vehicles – 13.4% on average – followed by real estate, renting, and business activities – 12.5% on average. Both these sub-sectors gain importance in most ECA countries during this

period.[5] Transport, storage, and communications is the third most important services sub-sector, representing 10.6% of value added on average in the ECA region. The share of this sub-sector also increases between 1997 and 2004 in all countries except Hungary and Estonia. While financial intermediation represents a relatively low share of total value added – 3.7% on average in the ECA region – it gains share in most countries from 1997 to 2004. In contrast, the contribution of electricity, gas, and water to total value added declines across most ECA countries between 1997 and 2004. Finally, note that the contribution of the various sub-sectors to value added in the ECA region is on average similar to that in EU-15 countries, also shown in Figure 2.

Figure 3 shows the average share of each services sub-sector in total employment across ECA countries in 1997-2000 and in 2001-2004. The major services sub-sectors in terms of the contribution to employment are wholesale, retail, and repair of motor vehicles – 13.1% on average – followed by transport, storage, and communications - 7.3% on average between 1997 and 2004. Wholesale, retail and repair of motor vehicles increases its share of employment between 1997 and 2004 in all but two countries.[6] The next most important sub-sector in the ECA region, real estate, renting, and business activities increases its share of employment substantially from an average of 4.5% in 1997-2000 to an average of 5.1% in 2001-2004. Hotels and restaurants also gain share in employment from 1997 to 2004 in all countries but Serbia and Montenegro and Romania. In contrast, the contribution of electricity, gas, and water to employment declines across most countries from 1997 to 2004, mirroring the finding for value added. With the exception of wholesale, retail, and repair of motor vehicles and hotels and restaurants, the shares of other sub-sectors in employment are much lower than their shares in value added.[7]

[5] The exceptions are Bulgaria where the share of both sub-sectors in value added falls and Romania where the share of wholesale, retail, and repair of motor vehicles falls between 1997 and 2004.
[6] The exceptions are the Czech Republic and Slovenia where the average share of wholesale, retail and repair of motor vehicles in employment is almost unchanged between 1997 and 2004.
[7] We should note that our data covers only formal economic activity. For example, the retail trade sub-sector is characterized by high levels of informality and therefore its contribution to value added and employment in ECA countries may actually be higher.

Figure 3: Share of Services Sub-Sectors in Employment



Source: WIIW database 2005 and KLEMS database 2007.

Complementary evidence on the importance of specific services sub-sectors across ECA countries is provided in Appendix Figures A.1 and A.2, which show the average share of each sub-sector in the WIIW database in services value added and services employment in 1997-2000 and in 2001-2004. Appendix Figures A.1 and A.2 along with Figures 2 and 3 suggest a relative specialization of particular ECA countries in particular sub-sectors. In hotels and restaurants, Croatia exhibits a substantially higher share of services value added and employment than the average for the ECA region, especially since 2001. Russia and Poland exhibit a particularly high share of services value added in wholesale, retail, and repair of motor vehicles during the entire period. In financial intermediation, Serbia and Montenegro displays a relatively high share of

services value added among ECA countries. Estonia and Hungary show well above-average shares of services value added in real estate, renting, and business activities, while Slovenia shows a particularly high share of employment in that sub-sector during 1997-2004. Finally, note that real estate, renting, and business activities is the only sub-sector for which there is a clear divide between EU-8 countries (with the exception of Lithuania) – where it is substantially more important for value added and employment – and South Eastern European countries and Ukraine.

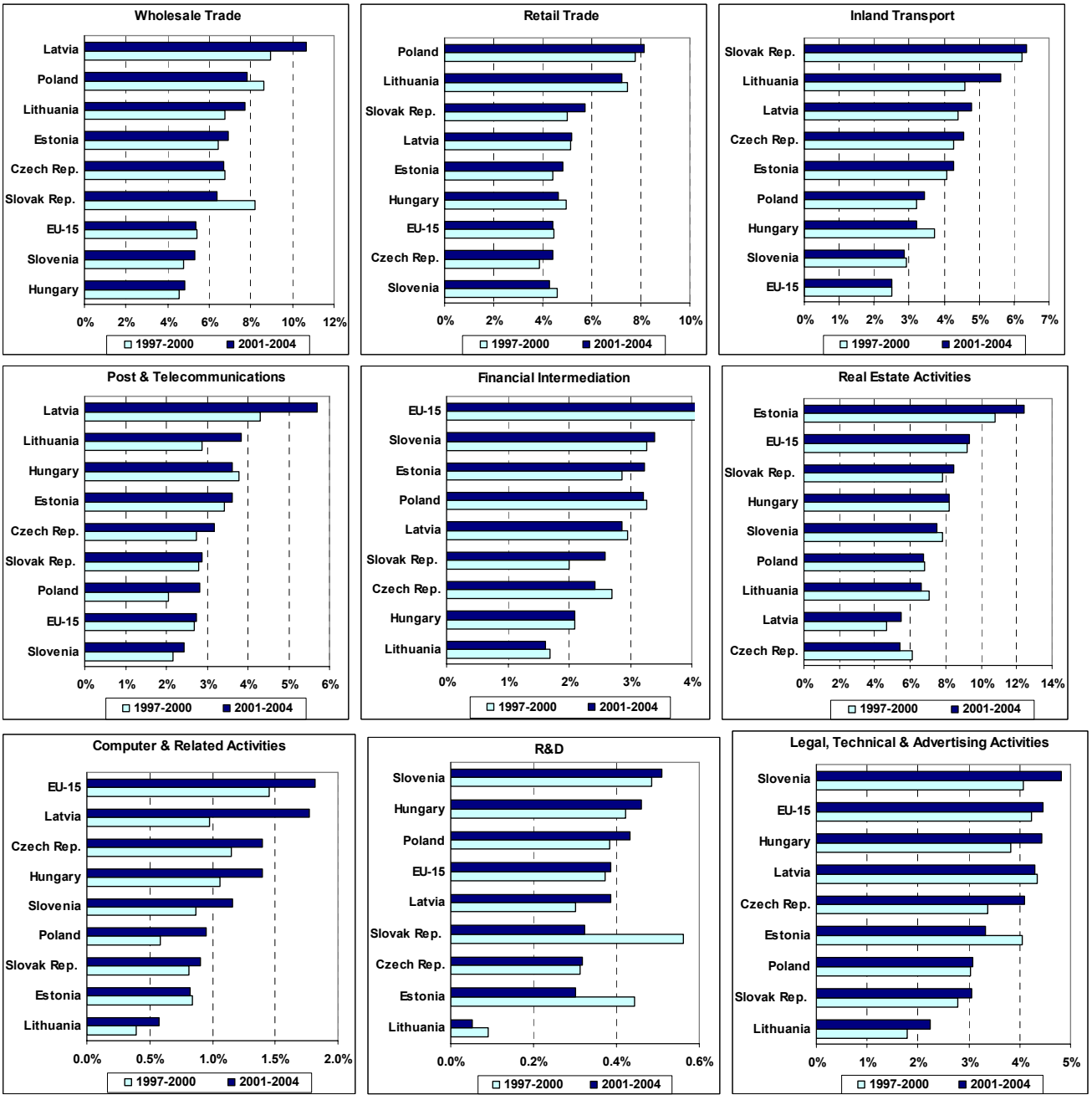
The patterns identified above do not inform on the importance of disaggregate sub-sectors such as software activities, which are part of the more aggregate sub-sector real estate, renting, and business activities. The KLEMS database provides information for 2-digit NACE sub-sectors which we use to document the importance of disaggregate services activities across ECA countries between 1997 and 2004. Given the large number of 2-digit NACE sub-sectors, we show in Figure 4 only the share of value added of sub-sectors that (i) represent more than 1% of total value added on average in EU-8 countries or (ii) have a high technological or skill content. Within wholesale, retail, and repair of motor vehicles, the most important sector is wholesale trade, whose average share in value added in 2001-2004 ranges from 4.8% in Hungary to more than 10% in Latvia. Retail trade is also important, particularly in Poland where it contributes more than 8% of value added. Within transport, storage, and communications, the most important sub-sectors in value added terms - representing 3% to 4% on average across EU-8 countries - are inland transport and post and telecommunications. Financial intermediation (excluding insurance and pension funding and activities auxiliary to financial intermediation) contributes more than 2% to value added in all EU-8 countries except Lithuania. Within real estate, renting, and business activities, real estate activities contribute the highest share to total value added (7.5% on average). Legal, technical, and advertising activities are the next most important sub-sector by their contribution to value added which increases in all EU-8 countries (except Estonia) between 1997 and 2004, averaging 3.7% in 2001-2004. Computer and related activities represent a small but growing share of value added in all EU-8 countries, reaching the highest average share in Latvia in 2001-2004 (1.8%). The share of wholesale trade, retail trade, inland transport, and post and telecommunications in value added in EU-15 countries, also shown in

Figure 4, is substantially smaller than that in EU-8 countries. In contrast, the average share of financial intermediation, real estate activities, and computer and related activities in value added is substantially higher in EU-15 countries than in EU-8 countries.

The relative contribution of disaggregate sub-sectors to employment shown in Appendix Figure A.3 is roughly similar to their contribution to value added shown in Figure 4. In particular, the employment share of financial intermediation and computer and related activities is substantially higher in EU-15 countries than in EU-8 countries. The employment share of real estate activities - 1.5% on average in EU-8 countries between 1997 and 2004 - is substantially smaller than its value added share.[8] This suggests an 'artificial inflation' in this sub-sector's value added, associated with the recent real estate boom in the ECA region. This real estate boom increases artificially the sub-components 'buying and selling of own real estate' as well as the sub-component 'letting of own property', as the latter imputes a rental value to homeowners. Evidence for the U.K. discussed by Crespi et al. (2006) shows an artificially 'inflated' value added for real estate activities. We will return to this issue in Section 3.

[8] Note that Appendix Figures A.4 and A.5 show for each of disaggregated sub-sector the average share in services value added and services employment in 1997-2000 and in 2001-2004. The figures suggest a relative specialization of particular ECA countries in particular services sub-sectors (e.g., retail trade in Poland, post and telecommunications in Latvia), mirroring the findings in Appendix Figures A.1 and A.2.

Figure 4: Share of Disaggregated Services Sub-Sectors in Value Added



Source: KLEMS database 2007.
Note: In this figure, financial intermediation is NACE 65 category.

3. Services Sector Performance: Patterns

To understand the potential for services-based growth in the ECA region, it is important to examine the recent performance of the sector. Performance will be measured by labor productivity defined to be the ratio of output to labor input. Defining physical

output in the services sector is intrinsically difficult, as pointed out by Griliches (1992) and Triplett and Bosworth (2004). Given the heterogeneity in output produced by each sub-sector, the common practice is to use value measures of output. Crespi et al. (2006) argue that the value of output of a sub-sector is the value of the bundle of intermediation services provided, which is well captured by real value added when the basis of the service is the change in condition of a consuming unit, such as in retail trade, but may be less well captured by real value added in sub-sectors such as legal, technical, and advertising activities (e.g., management consulting). Nevertheless, we use real value added to measure services output, as it is the only measure with wide cross-country and time coverage for the ECA region.[9] Labor productivity is obtained as the ratio of real value added to total employment in each services sub-sector. [10]

In order to perform cross-country comparisons of labor productivity within the ECA region, we need to convert a sub-sector's nominal value added at domestic prices in domestic currency into real value added at common prices in a common currency. Average exchange rates are inappropriate for this purpose since they reflect capital movements, monetary policies, and speculation, and do not adjust for differences in relative prices across countries. The appropriate procedure is to use purchasing power parity (PPP) conversion rates in order to express real value added in services sub-sectors across countries at a common set of prices in a common currency. Given the different information that the WIIW and the KLEMS databases include, we use two different types of PPP conversion rates and thus compute two different measures of real value added and of labor productivity for each services sub-sector and year in each country.

The WIIW database does not include output price deflators, therefore we transform each services sub-sector's nominal gross value added in domestic currency into real value added in PPP USD using country-level GDP deflators and 2001 country-level expenditure-based PPPs, applying the formula shown in Appendix B. Country-level expenditure-based PPPs convert domestic currency into PPP USD by equalizing the purchasing power of different currencies, thus eliminating the differences in price levels

[9] The use of value added instead of gross output is preferable for our analysis given the large number of countries covered, which may differ substantially in their ratios of intermediate inputs to gross output.
[10] Data on hours worked would be preferable to data on employment. However, that data is not available for ECA countries.

across countries. The measure of labor productivity based on this measure of real value added is henceforth designated as 'WIIW labor productivity'. While this approach is the only feasible for the WIIW database - which is of interest given its coverage of South Eastern European countries and Ukraine - it suffers from the drawback of not correcting for sub-sector specificity in domestic and international prices.

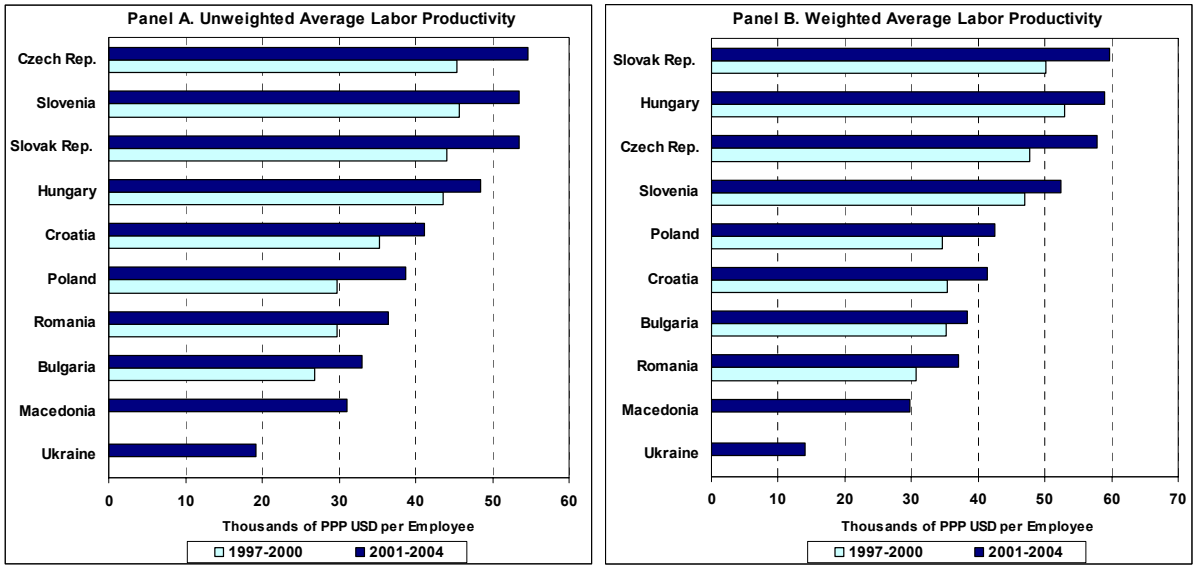
The KLEMS database includes output price deflators and production-based PPPs that are sub-sector specific, therefore we transform each services sub-sector's nominal gross value added in domestic currency into real value added in PPP euros using sub-sector specific output price deflators and 1997 sub-sector specific PPPs, applying the formula shown in Appendix B.[11] The measure of labor productivity based on this measure of real value added is henceforth designated as 'KLEMS labor productivity'.

Figure 5 gives a general perspective on the heterogeneity in services performance within the ECA region by showing unweighted (Panel A) and weighted (Panel B) averages of WIIW labor productivity in each country taken across all services sub-sectors in 1997-2000 and in 2001-2004. Weighted averages use as weights each sub-sector's share in services value added thus accounting for possible compositional effects in the unweighted averages (i.e., the fact that some sub-sectors are more important in certain countries, as shown in Section 2). Three messages emerge from Figure 5. First, average productivity in services varies substantially across countries. A productivity divide separates EU-5 countries from South Eastern European countries and Ukraine, with the latter exhibiting lower average productivity.[12] Second, weighted averages of WIIW labor productivity are higher than the corresponding unweighted averages in all countries. This finding indicates that more productive sub-sectors account for a larger share of services value added and hence suggests efficiency in the allocation of value added across sub-sectors. Third, both unweighted and weighted averages of WIIW labor productivity increase between 1997 and 2004 in all countries.

[11] Timmer et al (2007) describe in detail the computation of production-based sector-specific PPPs. However, the authors argue that expenditure-based PPPs are a reasonable approximation for sub-sectors which produce mainly for final consumption and whose products are hardly internationally traded.

[12] However, Croatia is an exception in that its unweighted average labor productivity is higher than that of Poland.

Figure 5: Average WIIW Labor Productivity in the Services Sector

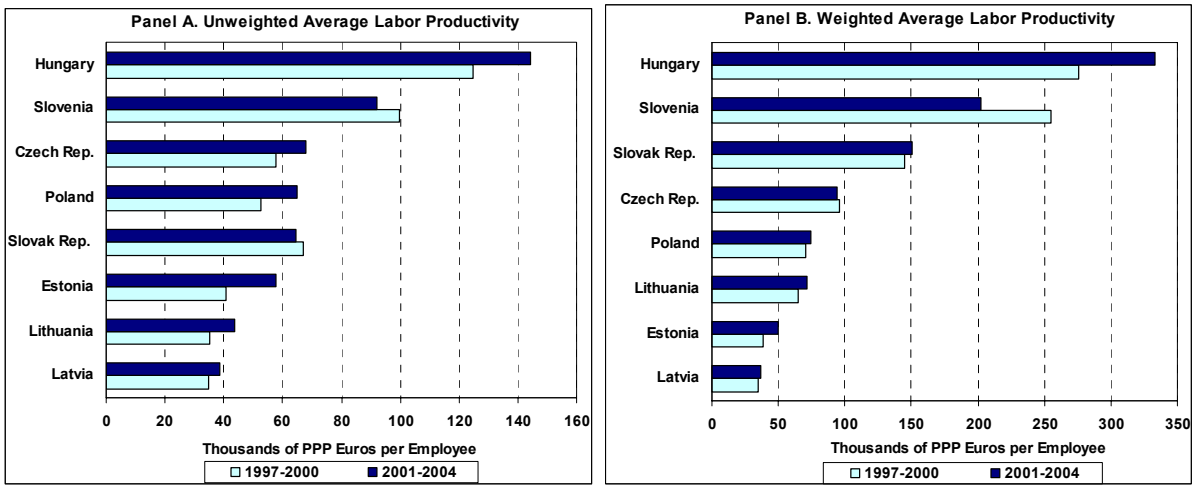


Source: WIIW database 2005.
Note: The averages of labor productivity are taken across the 6 sub-sectors listed in Appendix Table A.1.

Figure 6 shows unweighted (Panel A) and weighted (Panel B) averages of KLEMS labor productivity taken across all NACE 2-digit services sub-sectors in each country in 1997-2000 and in 2001-2004. The messages emerging from the figure are as follows. First, there is a large degree of heterogeneity in average KLEMS labor productivity in services across EU-8 countries. A productivity divide separates EU-5 countries from Baltic countries, which exhibit lower average productivity. Second, weighted averages are higher than unweighted averages of KLEMS labor productivity in all EU-8 countries but Latvia. Thus, in most countries more productive sub-sectors account for a larger share of services value added. Third, unweighted and weighted averages of KLEMS labor productivity increase between 1997 and 2004 in all EU-8 countries with the exception of Slovenia (for both averages) and the Slovak Republic (for the unweighted average). This finding differs from the evidence shown in Figure 5. Another difference relative to Figure 5 concerns the ranking of EU-5 countries according to their average labor productivity: while the Czech Republic (Panel A) or the Slovak Republic (Panel B) rank highest in Figure 5, Hungary ranks highest in both panels in Figure 6. This divergence is expected given that the use of sub-sector specific prices underlying Figure 6 differs substantially from the use of common prices across sub-

sectors underlying Figure 5. Moreover, the averages in Figures 5 and 6 are calculated over a different number of sub-sectors. Thus, it is possible that for some countries in Figure 6 a low productivity sub-sector influences unweighted and weighted averages of KLEMS labor productivity, while the same low productivity sub-sector is 'buried' under a more aggregate sub-sector in Figure 5 and thus does not influence unweighted and weighted averages of WIIW labor productivity.

Figure 6: Average KLEMS Labor Productivity in the Services Sector

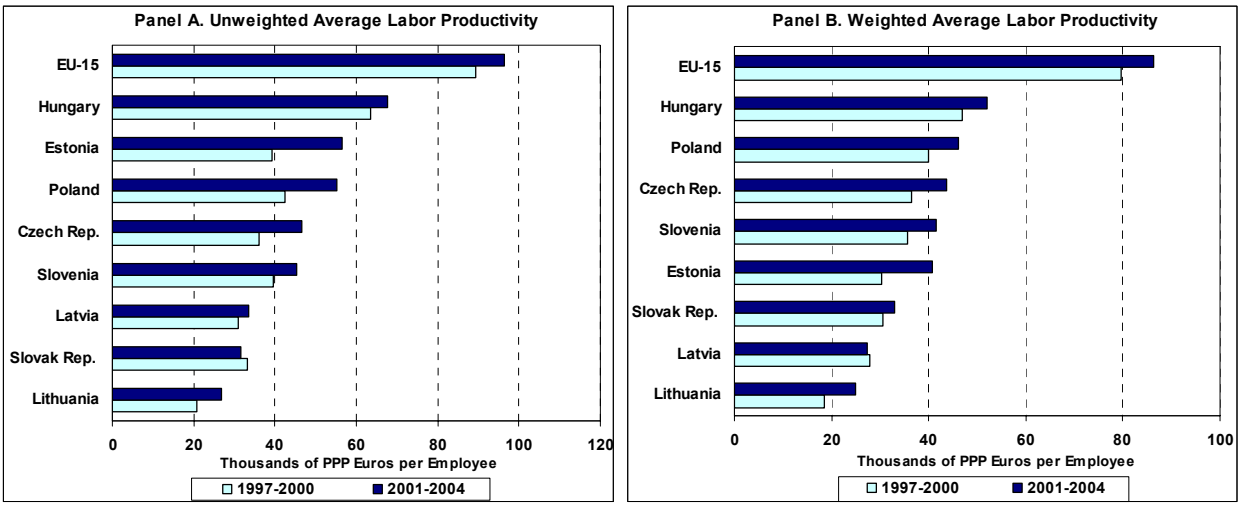


Source: KLEMS database 2007.
Note: The averages of labor productivity are taken across 21 NACE 2-digit sub-sectors listed in Appendix Table A.1.

Value added in real estate activities is very high during 1997-2004 as a result of a real estate boom in the ECA region while employment in that sub-sector is relatively low. Hence, labor productivity in that sub-sector is artificially high, particularly in Hungary, while this does not necessarily represent high efficiency. Hence, we show in Figure 7 unweighted and weighted averages of KLEMS labor productivity excluding real estate activities as these provide a more realistic representation of the average efficiency of services in EU-8 countries. In this figure the productivity divide between EU-5 countries and Baltic countries is less clear, although Hungary still exhibits the highest average productivity. In fact, Estonia ranks higher than the Czech Republic, Slovenia, and the Slovak Republic in terms of unweighted average KLEMS labor productivity and above the Slovak Republic and Slovenia in terms of weighted average KLEMS labor productivity. However, the figure shows that both unweighted and weighted averages of

KLEMS labor productivity increase substantially between 1997 and 2004 in all EU-8 countries except the Slovak Republic (for the unweighted average), as in Figure 6.

Figure 7: Average KLEMS Labor Productivity in the Services Sector Excluding Real Estate Activities



Source: KLEMS database 2007.
Note: The averages of labor productivity are taken across 19 NACE 2-digit sub-sectors listed in Appendix Table A.1 excluding real estate activities (NACE 70).

Figure 7 also shows that the efficiency of services in EU-8 countries lags clearly behind that in EU-15 countries. During 1997-2004, the best EU-8 performer Hungary exhibits unweighted (weighted) average labor productivity that is 70.7% (59.7%) of the EU-15 average labor productivity, while the worst EU-8 performer Lithuania exhibits unweighted (weighted) average labor productivity that is only 25.5% (26.1%) of the EU-15 average labor productivity.[13] However, note that between 1997 and 2004 the labor productivity gap between EU-8 countries and EU-15 countries is reduced. Considering weighted average KLEMS labor productivity, Hungary's level is 59% of the EU-15 level in 1997-2000 but increases to 60.3% in 2001-2004, while Lithuania's level is 23.2% of the EU-15 level in 1997-2000 but increases to 28.9% in 2001-2004.

[13] Labor productivity in the services sector for EU-15 countries is obtained as the average across all EU-15 countries of labor productivity in all sub-sectors, where KLEMS labor productivity for each sub-sector and country is calculated in similar way to KLEMS labor productivity for each sub-sector and ECA country. The consideration of a simple average of labor productivity across the more and less advanced EU-15 countries may actually underestimate its value. Hence, EU-8 countries may be significantly farther away from the labor productivity levels of the best performers among EU-15 countries.

The averages in Figures 5-7 suggest important differences in the performance of services within the ECA region. In particular, there is a clear divide among the most efficient services sectors of EU-8 countries and the least efficient services sectors of South Eastern European countries and Ukraine. At the same time, the figures show that labor productivity in services is enjoying healthy growth in the ECA region, particularly in the countries with lower average productivity, suggesting that catch-up and convergence is happening. However, these average patterns mask differences across very heterogeneous services sub-sectors, which we examine in the rest of the section.

First, we discuss the findings from comparisons of labor productivity across services sub-sectors within each country. Such comparison is subject to the 'apples to oranges' criticism. While this criticism would apply equally to the comparison of productivity across manufacturing sub-sectors, it is magnified for the services sector, given the difficulties in defining and measuring output. Nevertheless, we pursue these sub-sector comparisons within countries, focusing on the rankings rather than the magnitudes of labor productivity.[14] Based on WIIW labor productivity, some clear patterns emerge. Real estate, renting, and business activities exhibits the highest productivity across sub-sectors in 5 of the 10 countries and the second highest productivity in another 3 countries of the group of EU-5 countries, South Eastern European countries, and Ukraine. This finding is not surprising given the aforementioned 'inflation' of labor productivity in real estate activities. Indeed, we confirm based on the KLEMS database that real estate activities displays the highest average KLEMS labor productivity in all EU-5 countries also covered in the WIIW database. Financial intermediation displays the highest average productivity across sub-sectors in Croatia, Macedonia, and Ukraine, and the second highest productivity in another 5 of the 10 countries.[15] Hotels and restaurants exhibit the lowest productivity across sub-sectors in 7 of the 9 countries and the second lowest productivity in another country of the group of EU-5 countries and South Eastern European countries.[16]

[14] For brevity, we do not show the corresponding figures which are simply a different aggregation (by country) of the same statistics shown in Figures 8 and 9.
[15] Poland is an exception to the relatively high productivity of financial intermediation as this sub-sector exhibits the second lowest productivity in the country, only higher than that of hotels and restaurants.
[16] Ukraine is excluded for lack of data on hotels and restaurants.

Based on KLEMS labor productivity, we compare more disaggregate sub-sectors in EU-8 countries. Besides real estate activities, the other sub-sector that ranks among the top five in terms of productivity in 5 or 6 EU-8 countries is activities auxiliary to financial intermediation (NACE 67) and renting of machinery and equipment (NACE 71).[17] Hotels and restaurants and wholesale trade rank consistently among the least productive sub-sectors in EU-8 countries. The consistency in the ranking of services sub-sectors across ECA countries according to their labor productivity suggests that 'technological' characteristics such as capital intensity may play a role similar to what they play in explaining diverse labor productivity across manufacturing sub-sectors.

Comparing labor productivity of a given sub-sector across countries is not subject to the 'apples and oranges' criticism as one is comparing 'apples' produced under different economic environments. This may in fact indicate which environments encourage better performance by a sub-sector. However, this comparison is subject to the problem of cross-country heterogeneity in price and quality of the 'apples'. The use of expenditure-based PPPs (WIIW labor productivity) deals away only with general differences in price levels across countries, while the use of sub-sector specific production-based PPPs (KLEMS labor productivity) deals away with sub-sector specific differences in price levels across countries. To the extent that different prices reflect well differences in quality, the use of PPPs also mitigates the problem of different services' quality across countries.

Figure 8 shows WIIW labor productivity for each services sub-sector in ECA countries averaged in 1997-2000 and in 2001-2004. The evidence suggests a different 'comparative advantage' for different countries as no single country exhibits the highest WIIW labor productivity in all sub-sectors. Slovenia and the Czech Republic exhibit the highest, while Romania exhibits the lowest productivity in electricity, gas, and water. In wholesale, retail, and repair of motor vehicles, Poland is the most efficient while Ukraine is the least efficient. Poland's efficiency in wholesale, retail, and repair of motor vehicles is likely related to the importance of FDI in that sub-sector. Unfortunately we lack the data necessary to confirm this hypothesis. Romania displays the highest while the Slovak

[17] NACE 67 comprises administration of stock or commodity exchanges, security broking and fund management, and mortgage brokers.

Republic and Bulgaria display the lowest productivity in hotels and restaurants. Interestingly, two important tourist destinations, the Czech Republic and Croatia, have a less efficient hotels and restaurants sub-sector than Romania or Slovenia. In financial intermediation, the Slovak Republic exhibits the highest while Poland exhibits the lowest productivity.[18] Finally, in real estate, renting, and business activities, Hungary exhibits the highest while Ukraine exhibits the lowest productivity.

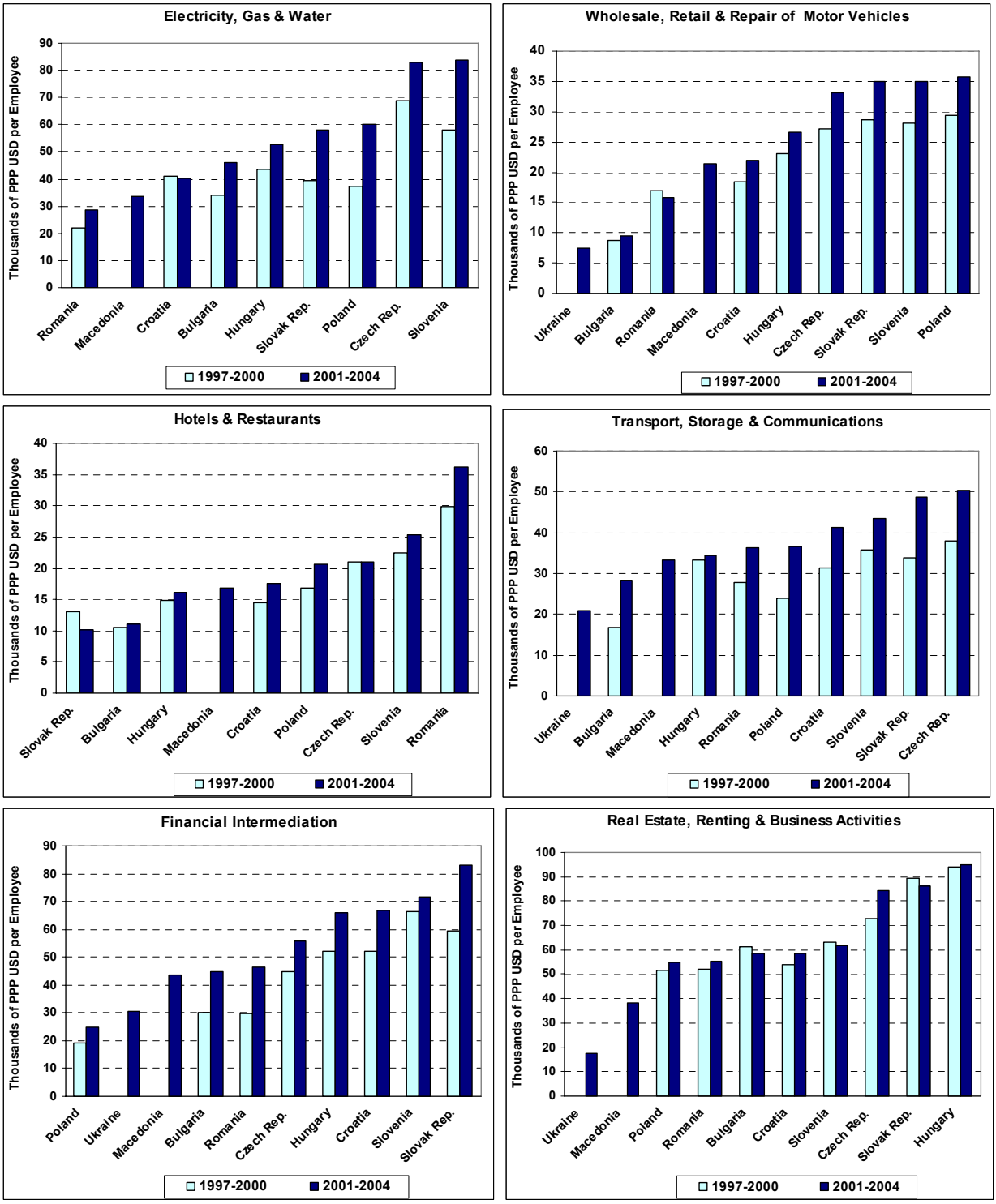
Figure 9 shows KLEMS labor productivity in EU-8 countries averaged in 1997-2000 and in 2001-2004. Again, the evidence suggests a different 'comparative advantage' for different countries. While the Czech Republic exhibits the highest productivity in wholesale trade, Poland is clearly the most productive in retail trade and in inland transport. In post and telecommunications and in financial intermediation, Slovenia displays the highest productivity of all EU-8 countries while Hungary exhibits the highest productivity in real estate activities. Finally, Estonia is relatively more productive in computer and related activities, in R&D, and in legal, technical, and advertising activities. Figure 9 also benchmarks for each sub-sector average KLEMS labor productivity in EU-8 countries relative to that in EU-15 countries. Interestingly, while on average EU-15 countries exhibit substantially higher productivity than ECA countries in services, that is not the case for all sub-sectors. A similar finding is obtained for manufacturing by Anos-Casero (2007). Estonia and Hungary exhibit higher productivity than EU-15 countries in computer and related activities and in legal, technical, and advertising activities. Estonia also exhibits higher productivity than EU-15 countries in R&D. In all other sub-sectors listed in Appendix Table A.1, EU-15 countries exhibit substantially higher productivity than EU-8 countries.[19]

In sum, Figures 8 and 9 show important differences in productivity levels of services sub-sectors within the ECA region. In general, a productivity divide separates EU-5 countries and Croatia which tend to be more efficient in all sub-sectors from South Eastern European countries and Ukraine, based on the WIIW database. Based on the

[18] This finding suggests that financial intermediation in Poland is lagging not only relative to other sub-sectors as is mentioned earlier, but also internationally within the ECA region.
[19] The only exception is air transport for which the Czech Republic is more productive than EU-15 countries on average in 2001-2004.

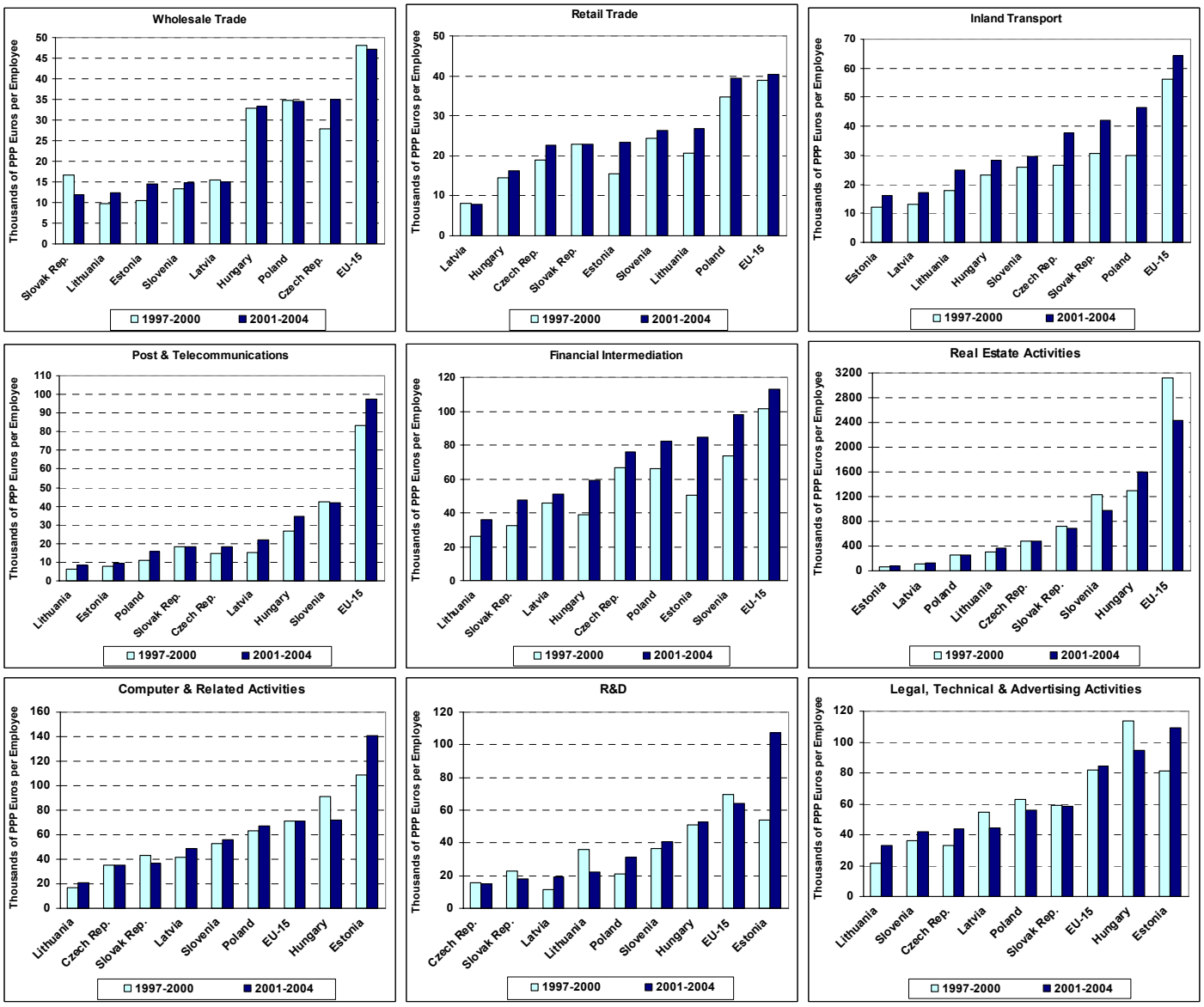
KLEMS database, the Baltic countries appear to be particularly productive in some sub-sectors.

Figure 8: Average WIIW Labor Productivity across Countries – By Sub-Sector



Source: WIIW database 2005.

Figure 9: Average KLEMS Labor Productivity across Countries – By Disaggregated Sub-Sector



Source: KLEMS database 2007.
Note: In this figure, financial intermediation is NACE 65 category.

Finally, we consider the performance of services sub-sectors in the ECA region from a dynamic perspective by examining average annual growth rates of labor productivity. Figure 10 shows average annual growth in WIIW labor productivity for each sub-sector across EU-5 countries, South Eastern European countries and Ukraine in 1997-2000 and in 2000-2004. Four main stylized facts that emerge from the figure. First, in all services sub-sectors there are important disparities in labor productivity growth rates across countries. Second, all sub-sectors with the exception of real estate, renting,

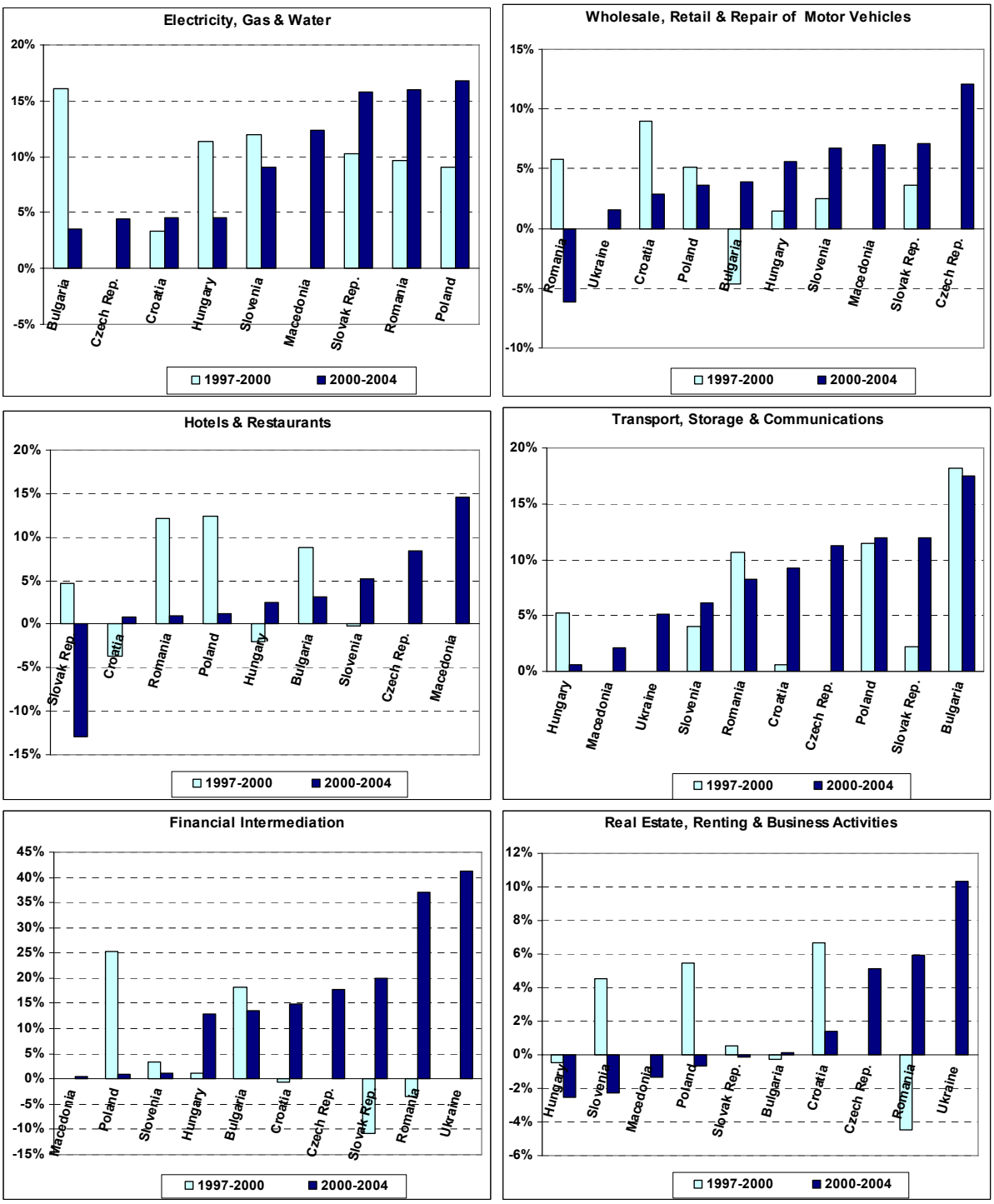
and business activities are characterized by strong productivity growth in the majority of ECA countries during 1997-2004.[20] For example, annual growth in WIIW labor productivity in financial intermediation averages 11.3% across all countries and years. Third, there is large variation in average annual growth rates of WIIW labor productivity between 1997-2000 and 2000-2004. In particular, productivity growth in electricity, gas, and water, in wholesale, retail, and repair of motor vehicles, and in financial intermediation accelerates in most countries in 2000-2004 relative to 1997-2000.[21] Fourth, despite the overwhelming evidence in Figure 10 of strong productivity growth, a few exceptions occur: (i) the Slovak Republic experiences an average annual decline of labor productivity in hotels and restaurants of more than 10% in 2000-2004, (ii) Bulgaria and Romania exhibit productivity declines in wholesale, retail, and repair of motor vehicles averaging 4.6% in 1997-2000 and 6% in 2000-2004, respectively, and (iii) Romania and the Slovak Republic display average annual productivity declines in financial intermediation of 3.5% and 10.9% in 1997-2000, respectively.

Comparing growth rates of WIIW labor productivity across sub-sectors is subject to the problem that GDP deflators used to deflate real value added account imperfectly for changes in sub-sector specific domestic and international output prices. Consequently, the labor productivity growth rates of some sub-sectors may be over-estimated while those of others may be under-estimated, depending on the evolution of the expenditure-based PPP conversion factors relative to the evolution of the production-based PPP conversion factors. Appendix Table B.1 shows for EU-5 countries - included in the WIIW and the KLEMS databases - growth in the expenditure-based PPP conversion factors and growth in the production-based PPP conversion factors for some sub-sectors from 1997 to 2004. It is very clear that the changes over time in domestic and international overall expenditure prices differ significantly from changes over time in domestic and international output prices across sub-sectors.

[20] The small or negative growth in labor productivity of real estate, renting and business activities may be associated with a stronger increase in employment than in value added of real estate activities as employment in the sub-sector took longer to respond to the real estate boom.

[21] Poland is an exception to this pattern for financial intermediation since its average annual growth in WIIW labor productivity is much stronger in 1997-2000.

Figure 10: Average Annual Growth in WIIW Labor Productivity in Services Sub-Sectors



Source: WIIW database 2005.

Notes: For each ECA country and sub-sector, geometric averages of labor productivity growth for 1997-2000 and 2000-2004 are shown. For EU-15 countries the growth rate of each sub-sector shown is the simple average across all EU-15 countries of their sub-sector's geometric average annual labor productivity growth rates in 1997-2000 and 2000-2004. In this figure, financial intermediation is NACE 65 category.

Figure 11 shows average annual growth in KLEMS labor productivity for each sub-sector across EU-8 countries in 1997-2000 and in 2000-2004. By comparing growth in KLEMS labor productivity across sub-sectors, this figure takes into account changes in sub-sector domestic and international output prices. Three main patterns emerge from the figure. First, there is enormous disparity in labor productivity growth rates across countries in all sub-sectors, as was the case in Figure 10. Second, retail trade, inland transport, post and telecommunications, and financial intermediation are characterized by strong productivity growth in most EU-8 countries in 1997-2004. Third, most sub-sectors exhibit large variation in average annual growth rates of KLEMS labor productivity between 1997-2000 and 2000-2004. Specifically, productivity growth in post and telecommunications and in financial intermediation (computer and related activities) accelerates (decelerates) in 2000-2004 relative to 1997-2000 in most EU-8 countries.

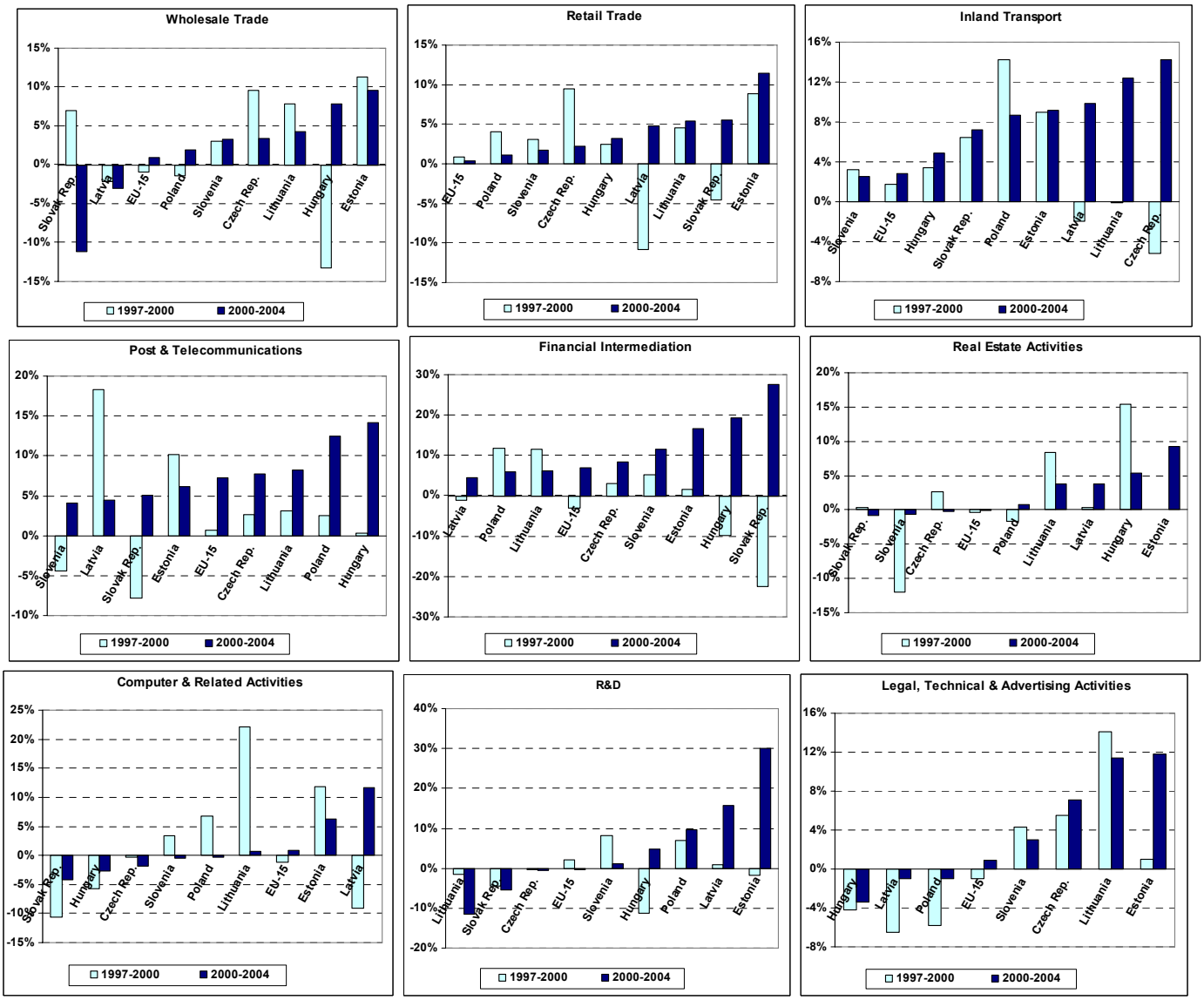
Figure 11 also shows average labor productivity growth rates in EU-15 countries. In all sub-sectors with the exception of post and telecommunications and computer and related activities, average labor productivity growth during 1997-2004 is lower in EU-15 countries than in most EU-8 countries. In fact, a similar type of finding is obtained even when comparing the labor productivity growth rates of more aggregate sub-sectors shown in Figure 10 to those in similar sub-sectors in OECD countries as documented by Wolfl (2003).[22] may reflect a catch-up effect given the large gap in services efficiency that separates ECA countries from other developed countries but also differences in economic performance during the 1997-2004 period, since EU-15 and other OECD countries register small GDP growth rates while some of the ECA countries exhibit strong GDP growth rates, especially since 2001.

The finding of accelerating labor productivity growth in 2000-2004 for the services sector in ECA countries is prima facie evidence in favor of the argument proposed by Ark and Piatkowski (2006) that the second 'expansionary' phase of sustained convergence of ECA countries towards EU-15 countries will rely importantly on the services sector. If recent productivity growth rates continue into the future, they will lead to improvements in efficiency of 'backbone' services sub-sectors such as

[22] Recall that the WIIW database does not allow direct benchmarking relative to EU-15 countries.

transport, telecommunication, and finance. Such efficiency improvements are crucial for the competitiveness of other sectors in the economy (via reductions in production costs) and their integration into global markets but also to facilitate the participation of ECA countries in the global fragmentation of services production.

Figure 11: Average Annual Growth in KLEMS Labor Productivity in Services Sub-Sectors



Source: KLEMS database 2007.
Notes: For each ECA country and sub-sector, geometric averages of labor productivity growth for 1997-2000 and 2000-2004 are shown. For EU-15 countries the growth rate of each sub-sector shown is the simple average across all EU-15 countries of their sub-sector's geometric average annual labor productivity growth rates in 1997-2000 and 2000-2004. In this figure, financial intermediation is NACE 65 category.

4. Services Sector Performance: Determinants

In Section 3, we identified important differences in labor productivity levels and growth rates across services sub-sectors and countries within the ECA region. Understanding the determinants of these differences in performance is crucial for policy purposes. Some important factors that may explain differences in performance across sub-sectors are capital intensity, market size and the scale at which services can be sold, human capital, technological innovations (particularly the use of ICT), policies and institutions (van Ark et al., 1999). Due to data limitations we follow different approaches to examine the role of ICT, skills, and policy reforms for the performance of services in the ECA region. While we can only examine the role of ICT and skills through simple taxonomies, we can assess the role policy reforms through econometric specifications.

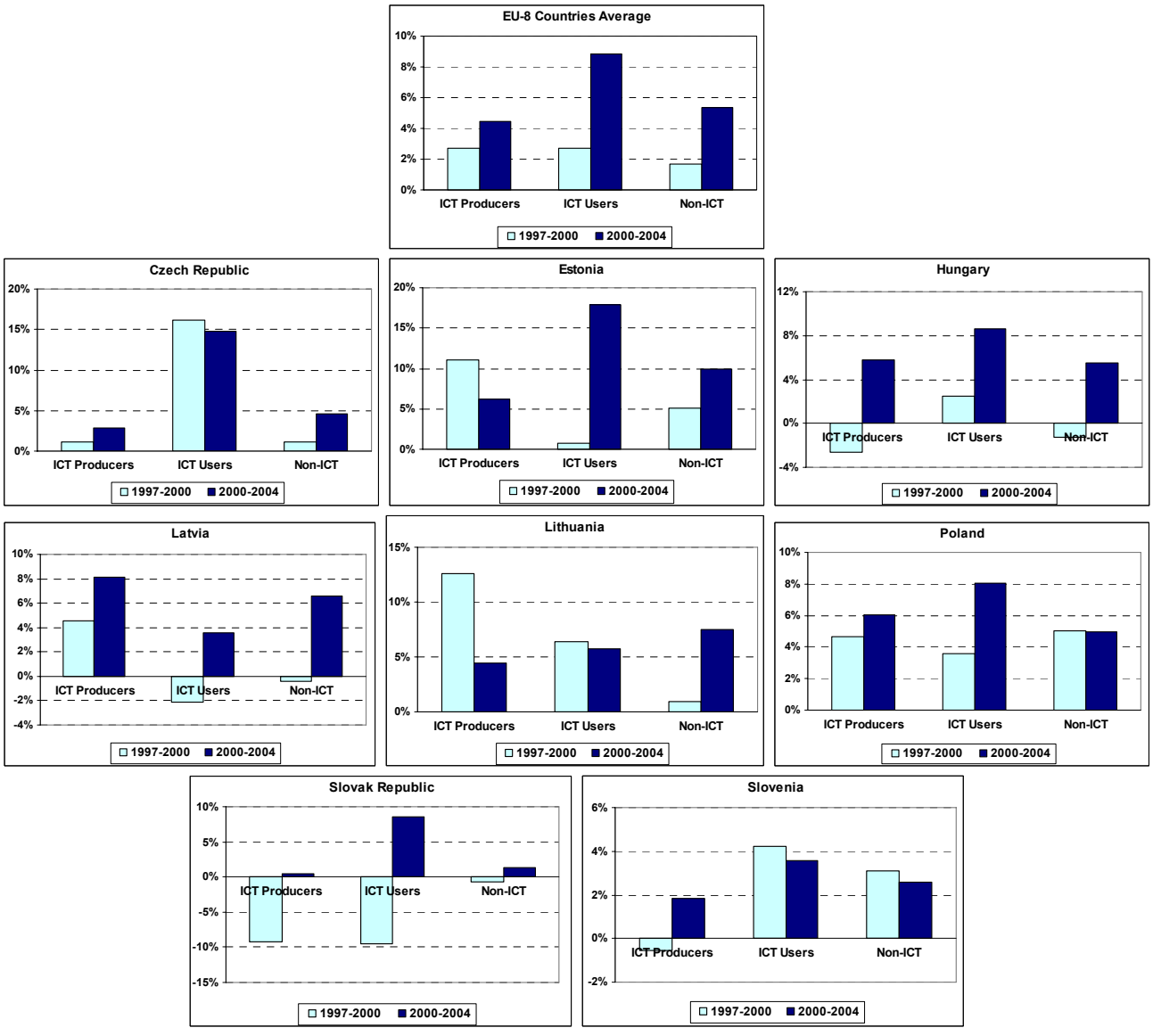
First, we assess the importance of ICT for the performance of services sub-sectors in ECA countries, relying on the taxonomy proposed by van Ark and Piatkowski (2004). A services sub-sector is categorized as an 'ICT producer' according to the OECD definition.[23] Alternatively, a services sub-sector is categorized as an intensive user of ICT ('ICT user') or as a non-intensive user of ICT ('Non-ICT') based on the ICT capital share of the sub-sector using the U.S. as a benchmark as in van Ark et al. (2003), given that data on ICT investment by sub-sector is not available for ECA countries. Appendix Table A.1 shows to which ICT category each of the NACE 2-digit services sub-sectors belongs. Unreported results show that ICT producers and ICT users exhibit substantially higher average KLEMS labor productivity levels than non-ICT sub-sectors in most EU-8 countries in 1997-2004.[24] Figure 12 shows average annual growth in KLEMS labor productivity across EU-8 countries in 1997-2000 and in 2000-2004 for each of the three ICT-related categories. For EU-8 countries overall, ICT users exhibit the fastest productivity growth in 1997-2000 while non-ICT sub-sectors exhibit the fastest productivity growth in 2000-2004. However, there is some heterogeneity across countries. In 2000-2004, ICT users experience the fastest productivity growth in all EU-8 countries except Latvia and Lithuania. In Hungary and Poland, ICT producers also

[23] The OECD defines as ICT producers the sub-sectors which produce IT hardware, communication equipment, telecommunications, or computer services (including software).

[24] This finding is valid when excluding real estate activities from the average productivity of non-ICT sub-sectors due to the aforementioned artificial over-estimation of labor productivity in this sub-sector. Note that it is impossible to classify the sub-sectors in the WIIW database into the ICT categories.

experience faster productivity growth than non-ICT sub-sectors. For these countries, the high productivity growth rates documented in Section 3 for financial intermediation and transport, storage, and communications can be rationalized by the introduction of cost-reducing ICT. In Latvia, ICT producers exhibit the highest productivity growth in 1997-2000 and in 2000-2004. Finally, note that the findings for the services sub-sectors in the ECA region match those for manufacturing sub-sectors for which better performance is associated with the production or use of ICT (Anos-Casero, 2007).

Figure 12: Average KLEMS Labor Productivity Growth and ICT in Services Sub-Sectors



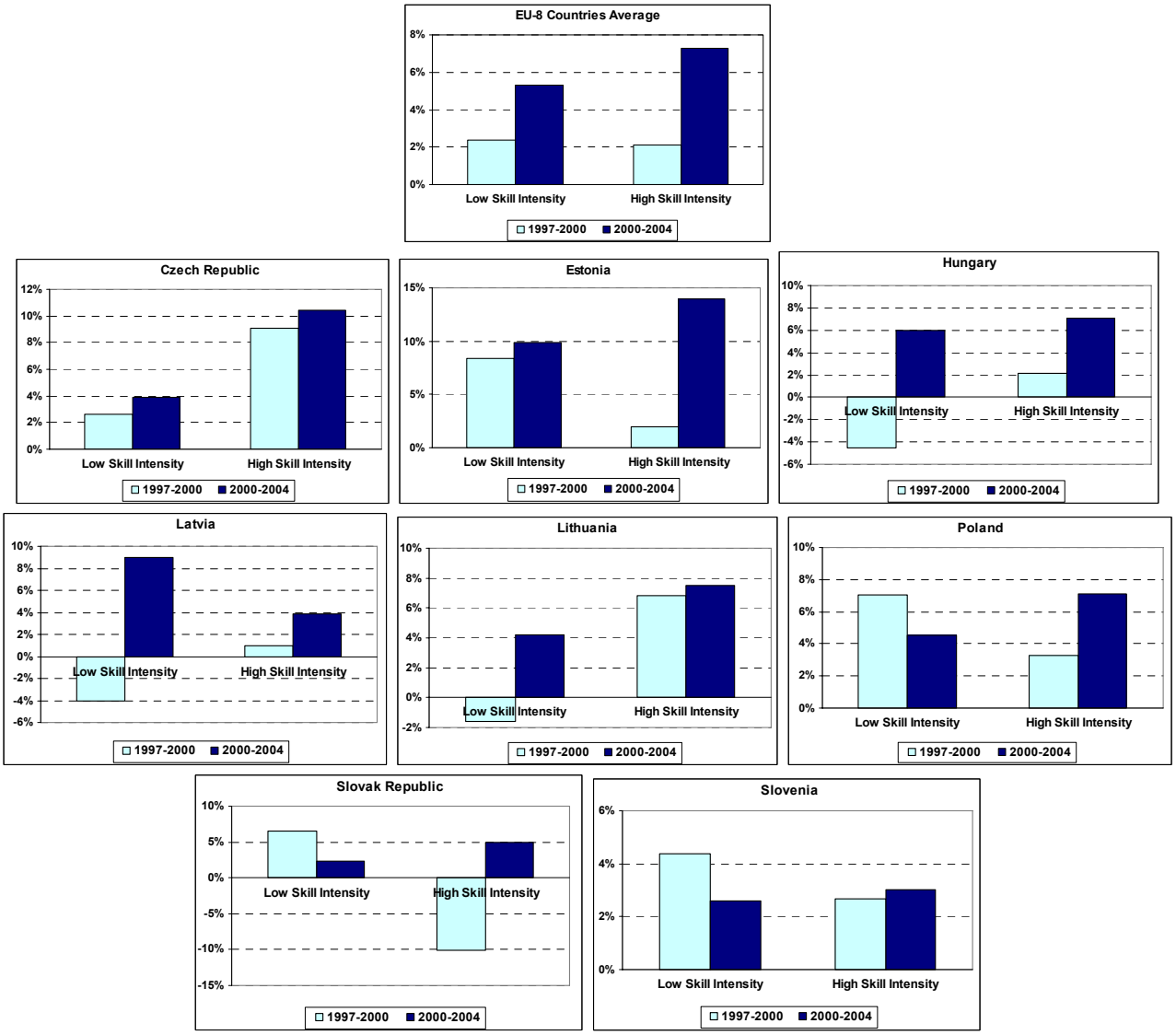
Source: KLEMS database 2007.
Note: For each country and ICT-related category, the figure shows the simple average taken across all sub-sectors in that category of their geometric averages of labor productivity growth in 1997-2000 and 2000-2004.

Second, we examine the role of skilled labor use for the performance of services sub-sectors in ECA countries relying on the taxonomy proposed by O'Mahoney and van Ark (2003). Services sub-sectors are categorized as 'high skill intensity' or 'low skill intensity' based on the average educational attainment of individuals working in each sub-sector using the E.U. and the U.S. as a benchmark, given that data by sub-sector is not available for ECA countries. Appendix Table A.1 shows to which skill category each of the NACE 2-digit services sub-sectors belongs. Unreported results show that high skill intensity sub-sectors exhibit substantially higher average KLEMS labor productivity levels than low skill intensity sub-sectors in all EU-8 countries in 1997-2004. Figure 12 shows average annual growth in KLEMS labor productivity across EU-8 countries in 1997-2000 and in 2000-2004 for the two skills-related categories. For EU-8 countries, high skill intensity services sub-sectors exhibit faster productivity growth than low skill intensity sub-sectors in 2000-2004, while the average growth rates in 1997-2000 are similar across both types of sub-sectors. Note that the findings for services sub-sectors in these countries match those for manufacturing sub-sectors for which better performance is associated with a more intensive use of skilled workers (Anos-Casero, 2007). The similarity of conclusions for the ICT and skills taxonomies is not surprising given that many of the high skill intensive sub-sectors are those which produce or use intensively ICT. Also, the less favorable performance of high skill intensive sub-sectors relative to low skill intensive sub-sectors in 1997-2000 raises the possibility that earlier in the transition ECA countries did not develop sufficiently the skills required to use intensively the new technologies.

Third, the performance of services sub-sectors across ECA countries is tied to the progress of policy reforms leading to liberalization of these sub-sectors. Eschenbach and Hoekman (2006) discuss in detail the content of services policy reforms in ECA countries and the progress made in terms of liberalization. These policy reforms combine deregulation (e.g., dismantling of barriers to entry and promotion of competition) and improved regulation (e.g., setting up of an appropriate legal environment, strengthening and increasing the independence of regulatory agencies). On average, more progress in liberalization reforms has been achieved in the telecommunications and the electricity sub-sectors and in Central European countries. Despite significant progress, ECA

countries still exhibit high levels of product market regulation that stifle competition, growth, and innovation in the services sector (OECD, 2005). Moreover, there is still significant cross-country heterogeneity in the degree of liberalization and the quality of the regulatory framework facing the services sector, which may help explain the differences in performance documented in Section 3.

Figure 13: Average KLEMS Labor Productivity Growth and Skills in Services Sub-Sectors



Source: KLEMS database 2007.
Note: For each country and skills-related category, a simple average is taken across all sub-sectors in that category of their geometric averages of labor productivity growth in 1997-2000 and 2000-2004.

To capture the extent of services liberalization across ECA countries, we use the European Bank for Reconstruction and Development (EBRD) index of progress in policy

reforms which is sub-sector specific and time-varying between 1997 and 2004. The services sub-sectors covered by the EBRD index are electric power, water distribution, road transport, telecommunications, banking reform and interest rate liberalization, and non-bank financial institutions. To combine the EBRD index with the WIIW database, we average the index to match the sub-sectors covered by that database.[25] To combine the EBRD index with the KLEMS database, there is no need for aggregation since the services sub-sectors covered by the EBRD index match almost perfectly the NACE 2-digit sub-sectors covered by that database.[26]

Panel A of Figure 14 illustrates the correlation between the average EBRD index and average WIIW labor productivity levels in the corresponding sub-sector during 1997-2004. The EBRD index ranges from 0 to 4 with higher values of the index indicating more liberalization achieved. The figure provides some evidence of higher WIIW labor productivity in countries where services sub-sectors are more liberalized. While the evidence is weaker within the group of EU-5 countries, it is stronger when contrasting EU-5 countries and Croatia where more liberalization has been achieved with other South Eastern European countries and Ukraine where less liberalization has been achieved. The evidence of a positive association between liberalization and performance is clearer for financial intermediation, with Poland being an exception.

Panel B of Figure 14 illustrates the correlation between the average EBRD index and average KLEMS labor productivity levels in the corresponding NACE 2-digit sub-sector in 1997-2004. Focusing on these more disaggregate sub-sectors, there is no clear evidence of higher KLEMS labor productivity in EU-8 countries with more liberalized services sub-sectors. One possible rationale for the difference in findings across Panels A and B of Figure 14 is the fact that Panel A focuses on a more homogeneous group of countries for which faster and deeper liberalization was required for EU accession in 2004. Another rationale for the difference in findings between Panels A and B is the

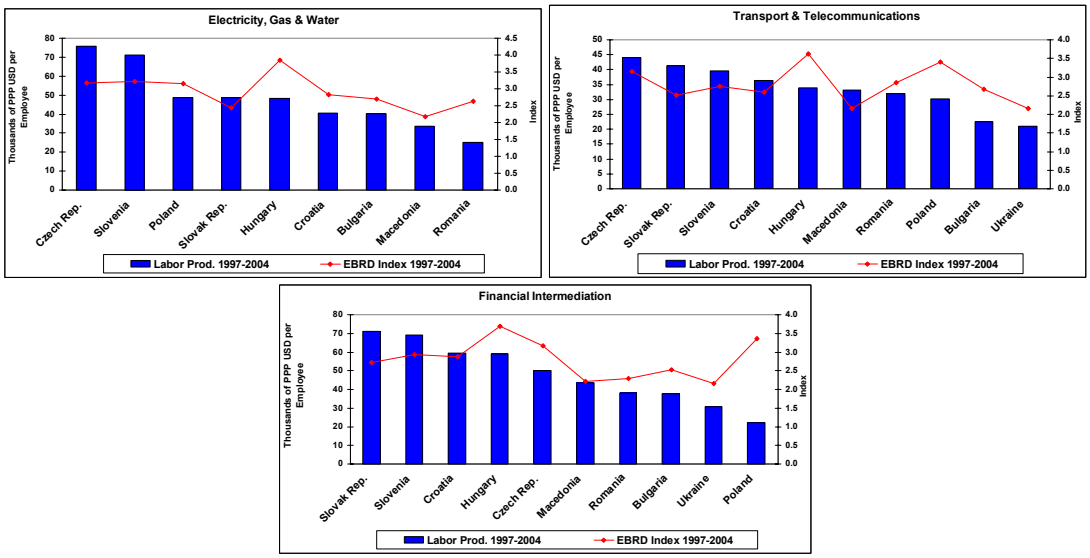
[25] Specifically, we average (1) the EBRD index for electric power and the EBRD index for water distribution to match the sub-sector electricity, gas, and water; (2) the EBRD index for road transport and the EBRD index for telecommunications to match the sub-sector transport, storage and telecommunication; and (3) the EBRD index for banking reform and interest rate liberalization and the EBRD index for non-bank financial institutions to match the sub-sector financial intermediation.

[26] The only adjustment required is to average KLEMS labor productivity in insurance and pension funding (NACE 66) and in activities auxiliary to financial intermediation (NACE 67) to match the EBRD index for non-bank financial institutions.

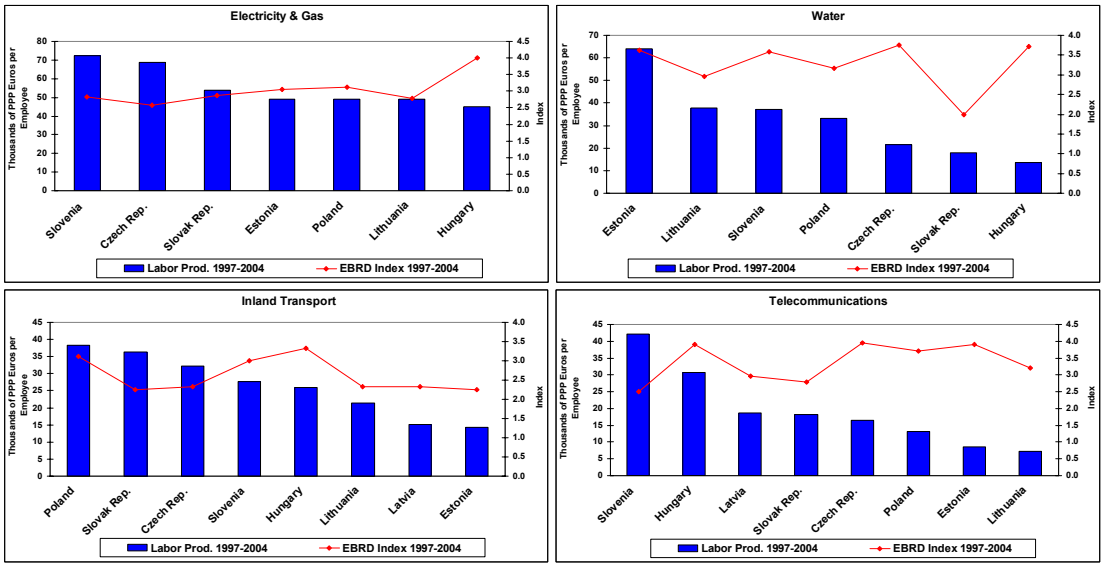
different sub-sectoral disaggregation considered. In fact, when we average KLEMS labor productivity and EBRD indexes for the 6 sub-sectors shown in Panel B to the level of the 3 sub-sectors in Panel A, the results provide broad evidence of a positive correlation between performance and progress in policy reform (see Appendix Figure C.1). This finding can be rationalized by the fact that a sub-sector may benefit from policy reform affecting closely related sub-sectors.

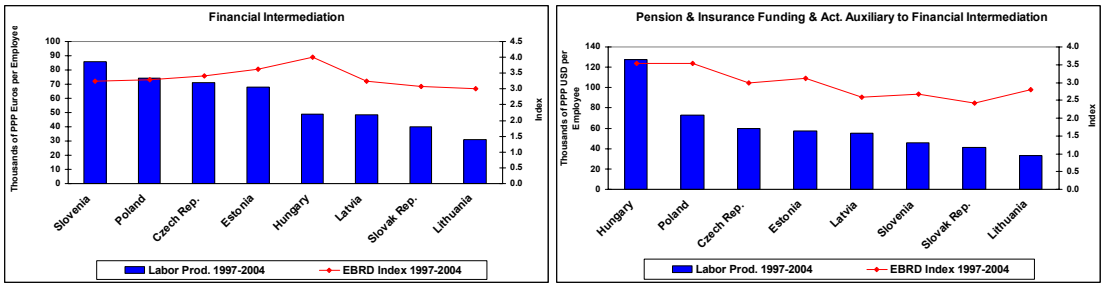
Figure 14: Policy Reform and Labor Productivity

Panel A. WIIW Labor Productivity



Panel B. KLEMS Labor Productivity





Source: WIIW database 2005, KLEMS database 2005 and EBRD Transition Report.
Note: In Panel B financial intermediation is NACE 65 category.

Heterogeneity in demand conditions across countries as well as other unaccounted for factors can influence the performance of different services sub-sectors. Therefore, it is not surprising that Panels A and B of Figure 14 uncover only a weak relationship between the EBRD index and labor productivity across services sub-sectors. Regression analysis can control for this heterogeneity. Table 1 shows the results from regressions of growth in WIIW labor productivity (Panel A) or growth in KLEMS labor productivity (Panel B) on one year lagged values of the EBRD index. The regressions are estimated using (i) OLS including country dummies, sub-sector dummies, year dummies, and an interaction between sub-sector dummies and year dummies, or (ii) sub-sector fixed effects including year dummies. Year dummies account for business cycle or other macroeconomic factors affecting equally all sub-sectors, while services sub-sector dummies account for fixed differences in productivity growth across sub-sectors. The interaction dummies control for problems in the measurement of output in services sub-sectors and for problems related to the use of imperfect deflators for real value added.

The results in Panels A and B of Table 1 suggest a positive effect of liberalization on services labor productivity growth. However, the effects are relatively weak except in column (1) of Panel B. The weakness of results may be due to data problems: (i) small sample size as the regressions include for each country and year only the services sub-sectors for which EBRD indexes are available which are 3 in Panel A (those shown in Panel A of Figure 14) or 6 in Panel B (those shown in Panel B of Figure 14), and (ii) imperfect measurement of progress in liberalization by the EBRD indexes. The weak results may also indicate that liberalization has not yet translated into an improvement in performance because the reforms have not been deep enough or because they require

complementary improvements in other aspects of the business environment. Finally, note that the results using two year lagged values of the EBRD index are qualitatively similar to those shown in Table 1.

Table 1: Effects of EBRD Index on Services Sub-Sector Performance

Panel A. Dependent Variable is Growth in WIIW Labor Productivity

	OLS	Fixed Effects
	(1)	(2)
One Year Lagged EBRD Index	0.034	0.018
	[0.084]	[0.066]
Year Dummies	Yes	Yes
Country Dummies	Yes	
Sub-Sector Dummies	Yes	
Year Dummies*Sub-Sector Dummies	Yes	
N. Observations	149	149

Panel B. Dependent Variable is Growth in KLEMS Labor Productivity

	OLS	Fixed Effects
	(1)	(2)
One Year Lagged EBRD Index	0.056	0.041
	[0.022]**	[0.035]
Year Dummies	Yes	Yes
Country Dummies	Yes	
Sub-Sector Dummies	Yes	
Year Dummies*Sub-Sector Dummies	Yes	
N. Observations	329	329

Notes: Robust standard errors in parenthesis. ** indicates significance at the 5% confidence level.

Overall, the messages regarding the link between performance, ICT, skills, and liberalization in the services sector in ECA countries are as follows: (i) labor productivity levels are higher for ICT producers or ICT users and for high skill intensive sub-sectors during 1997-2004, and (ii) productivity growth rates are higher for ICT users and for high skill intensive sub-sectors in most EU-8 countries after 2000. These findings suggest a progressive penetration and efficient use of ICT in the services sectors of EU-8 countries during 1997-2004. However, the penetration and efficient use of ICT in services are still in progress. ICT can potentially translate into further productivity gains and be a crucial factor in reducing the large services productivity gap between ECA countries and EU-15 countries, especially if combined with the continuation of structural reforms, namely further liberalization of the services sector and its opening to FDI. The development of efficient, low-cost, and broadly diffused telecommunication networks should therefore rank high in the policy-makers' growth agenda across ECA countries. Such development can be fostered by improvements in competition and continued liberalization of the

telecommunications sub-sector. Similarly, the development of workforce skills required to use ICT intensively should also be a priority in the growth agenda of ECA countries.

Finally, we close this section with three important remarks. First, FDI inflows would be an important variable to consider in order to explain the divergence in performance across sub-sectors and countries. Collecting disaggregated and time-varying FDI data for services sub-sectors should be a priority for statistical agencies in ECA countries, to allow a thorough assessment of the effects of FDI. Second, regulatory reform in sub-sectors such as wholesale and retail trade which have generated substantial improvements in productivity in OECD countries (OECD, 2005) are not covered by the EBRD index. Assessing the effect of reforms in those sub-sectors in ECA countries should be a priority for future research. Finally, the liberalization of services can influence average performance in a sub-sector through several margins: by increasing average productivity for incumbent firms but also by allowing new entry of firms, likely to be more innovative and successful in meeting consumer demand, and by encouraging the exit of less productive firms. Analyzing these margins is possible only through the use of firm-level similar to manufacturing census data. Statistical agencies in ECA countries should be encouraged to collect such data to enable policy-makers to understand the dynamics of productivity and growth in the services sector.

5. The Effect of Services Liberalization on Manufacturing

The efficiency of services sub-sectors is important per se as these sectors increasingly contribute to the economies of the ECA region but also because services are important inputs for downstream sectors. Hence, liberalization-related improvements of the performance of the services sector can be crucial for growth promotion. Indeed, Eschenback and Hoekman (2006) show that progress in services policy reforms helps explain differences in economic growth across ECA countries since 1990. Arnold et al. (2006a) find a significant positive effect of services liberalization and FDI in the services sector on manufacturing firms' total factor productivity (TFP) in the Czech Republic. Similarly, Arnold et al. (2006b) find a significant positive effect of regional availability of communications, electricity, and financial services on TFP for a large cross-section of manufacturing firms across several African countries.

We apply the Arnold et al. (2006a) approach to 9 ECA countries – Bulgaria, the Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Slovenia, and the Slovak Republic - to examine the effect of liberalization in services sub-sectors on downstream manufacturing productivity. Our dependent variable is labor productivity for 2-digit NACE manufacturing sub-sectors in those 9 countries obtained from the *WIIW Industrial Database Eastern Europe* from 1997 to 2004. For each country and year, labor productivity in a manufacturing sub-sector is expressed as a ratio to the average labor productivity in manufacturing overall.[27] Since labor productivity is measured in relative terms, problems of deflation of real value added analogous to those discussed in Section 3 for services sub-sectors are avoided. However, the use of labor productivity in relative terms implies that the comparison of levels across countries is not meaningful and thus that controlling for country and year dummies in the regressions is essential.

Our independent variable is a measure of liberalization in services sub-sectors weighted by the reliance of a given manufacturing sub-sector on inputs from each services sub-sector. Input-output matrices for each of the 9 countries are used to capture the inter-sectoral dependencies between services sub-sectors and manufacturing sub-sectors. More specifically, the independent variable is given by $services\_link^{c}_{it-1} = \sum_{k} a_{ik} * EBRD^{c}_{kt-1}$, where a_{ik} is the quantity of inputs sourced by manufacturing sub-sector *i* from services sub-sector *k* as a fraction of the total inputs used by manufacturing sub-sector *i* and $EBRD^{c}_{kt-1}$ is the EBRD index of progress in policy reform in services sub-sector *k* in year *t-1*.[28] Considering lagged values of the EBRD index allows time for the effects of liberalization in the services sector to materialize.

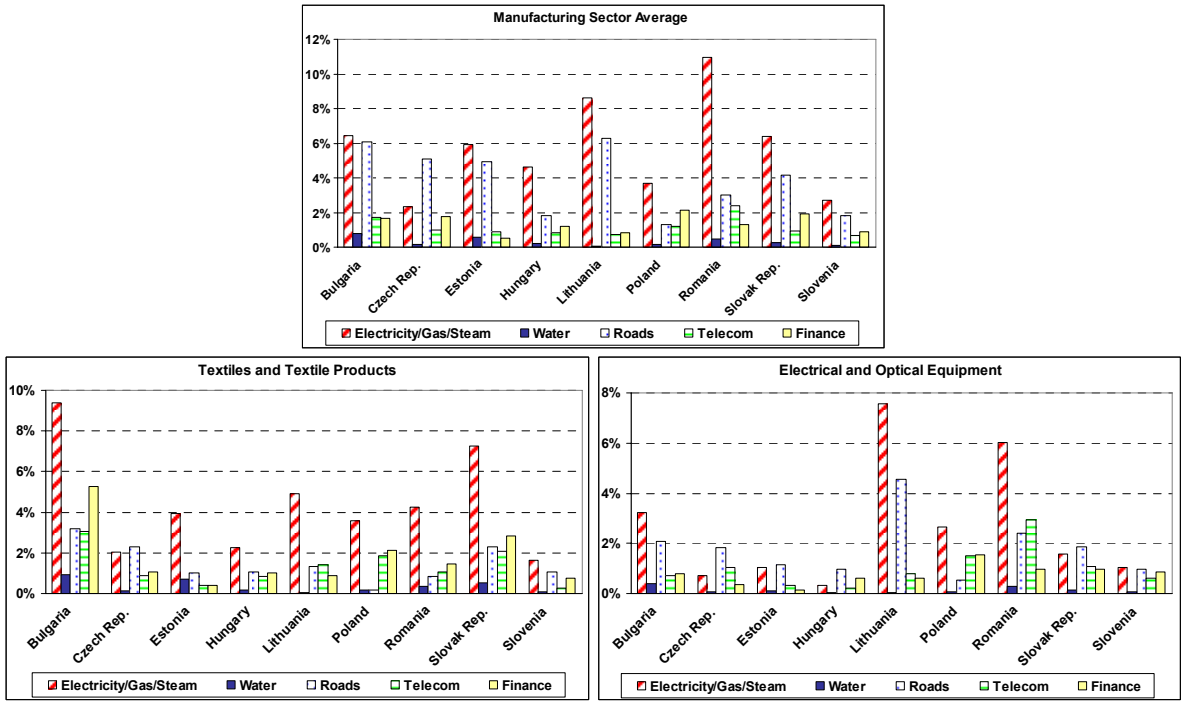
Interestingly, we find that the usage of inputs from services sub-sectors by the manufacturing sector varies greatly across ECA countries. Figure 15 shows the intensity of usage of each of the services sub-sectors (for which the EBRD index is available) by the manufacturing sector overall and by two manufacturing sub-sectors: textiles and

[27] For example, labor productivity of 0.8 indicates that the sub-sector is 80% as productive as the manufacturing sector overall.

[28] The input-output tables provide information on input usage by 2-digit NACE manufacturing sub-sectors from each 2-digit NACE services sub-sector as well as from all sectors in the economy, which allow us to calculate a_{ik}.

textile products and electrical and optical equipment.[29] For the manufacturing sector overall, inputs from electricity, gas, and steam represent the highest share of total inputs used in almost all ECA countries, ranging from an average of 2.3% of total inputs used in the Czech Republic to an average of 11% of total inputs used in Romania.[30] Across ECA countries with the exception of Lithuania and Romania, inputs from electricity, gas, and steam represent a higher share of the total inputs used by textiles and textile products than of those used by electrical and optical equipment. The second most important services sub-sector in terms of input provision to the manufacturing sector overall is road transport, whose share in total inputs ranges from an average of 1.3% in Poland to an average of 6.3% in Lithuania. Incidentally, these figures show that the production process - in terms of the type of services inputs used - of any given manufacturing sub-sector differs substantially across countries.

Figure 15: Intensity of Usage of Inputs from Services Sub-sectors by Manufacturing



Source: Input-output tables described in Appendix Table A.2.

[29] For each country and services sub-sector, the intensity of the manufacturing sector overall is obtained as an average of the linkage coefficients a_{ik} across all manufacturing sub-sectors.

[30] Note that in the Czech Republic inputs from road transport represent a higher share of total inputs.

Our empirical strategy consists of estimating the following equation:

$$lprod_{it}^{c} = \beta_0 + \beta_1 services\_link_{it-1}^{c} + I^{c} + I_t + I_j + I_t * I_j + \varepsilon_{it}^{c}, \quad (1)$$

where $lprod_{it}^{c}$ is labor productivity of manufacturing sub-sector i (relative to labor productivity of manufacturing overall) in year t and country c, I^{c} are country dummies, I_t are year dummies, I_j are manufacturing sub-sector dummies, and $I_t * I_j$ is an interaction of year dummies and manufacturing sub-sector dummies, and ε_{it}^{c} is an i.i.d. residual. Year dummies account for policies or business cycle aspects affecting all manufacturing sub-sectors equally while manufacturing sub-sector dummies and the interaction term account for unobservable differences in labor productivity that are constant for each sub-sector (e.g., some sub-sectors are operate with higher capital intensity resulting in higher labor productivity) or time-varying for each sub-sector, respectively.[31] Table 2 presents the results from estimating Equation (1) using OLS, fixed effects, and first-differenced regressions. Arnold et al. (2006a) argue that services liberalization in the Czech Republic can be considered exogenous to manufacturing productivity since the European Commission exerted a tight supervision on policy reform in preparation for that country's EU accession in 2004. A similar argument applies to the countries included in our analysis, thus we are not concerned about reverse causality problems in the regressions whose results are shown in Table 2. Also, given that labor productivity is expressed in relative terms, we do not attach meaning to the magnitude of the coefficients in Table 2 but only to their sign and significance.

The estimates in columns (1) and (2) show that there is a positive and significant effect of services liberalization on labor productivity of downstream manufacturing. More specifically, the coefficients indicate that, within ECA countries, manufacturing sub-sectors that rely more heavily on inputs from more liberalized services sub-sectors exhibit higher productivity than other manufacturing sub-sectors. The coefficient in column (3) is positive but insignificant which is not surprising given that the first-differenced specification imposes strong demands on the data. Finally, note that the

[31] Since we focus on estimating the effect of services liberalization on manufacturing sub-sectors that use services inputs, the various dummies are also used to control for all other determinants of performance of manufacturing sub-sectors.

results are qualitatively similar when we consider two year lagged values of the EBRD index.

Table 2: Effects of Services Liberalization on Manufacturing Productivity

	Dependent Variable is Labor Productivity in Manufacturing Sub-Sectors		
	OLS	Fixed Effects	First Differenced
	(1)	(2)	(3)
Linkage Finance + Electricity, Water, Roads, Telecom to One Year Lagged EBRD	2.107	2.107	0.196
	[0.368]***	[0.202]***	[0.618]
Year Dummies	Yes	Yes	Yes
Country Dummies	Yes		
NACE 2-Digit Dummies	Yes		
Year Dummies*NACE 2-Digit Dummies	Yes		
N. Observations	820	820	695

Notes: Robust standard errors in parenthesis. *** indicates significance at the 1% confidence level.

Our findings support the idea that services liberalization in ECA countries is beneficial for the productivity of the manufacturing sector. Our findings across 9 ECA countries mirror those in Arnold et al. (2006a) for a single country, despite the fact that we use a simpler productivity measure and we do not control for other determinants of manufacturing productivity such as FDI or competition. However, we should note that for the 9 ECA countries considered the beneficial effect of liberalization occurs only when reforms in ***both*** essential backbone services - finance and infrastructure - occur. In fact, unreported results on the effects of liberalization in each of the sub-sectors separately suggest that liberalization in a single sub-sector is not conducive to higher productivity in downstream manufacturing.

6. Conclusion

This paper examines recent trends in the structure and performance of the services sector in ECA countries between 1997 and 2004. Services represent on average 46% of total value added and 31% of total employment in the ECA region during this period. The major services sub-sectors in terms of value added and employment are wholesale trade, retail trade, inland transport, telecommunications, and real estate activities.

We find a clear divide in terms of labor productivity in services separating EU-5 countries from South Eastern European countries and Ukraine. While we also find a large

gap in services productivity between EU-8 countries and EU-15 countries, the gap has been reduced between 1997 and 2004. For all services sub-sectors, we find large disparities in labor productivity across ECA countries, with Ukraine exhibiting generally the lowest productivity. Most services sub-sectors are characterized by strong labor productivity growth from 1997 to 2004 in all ECA countries. Services sub-sectors that are ICT producers or users or those that are high skill intensive exhibit on average higher labor productivity levels during 1997-2004 in most ECA countries and higher labor productivity growth rates since 2000, relative to other sub-sectors. We find evidence of a positive effect of liberalization on labor productivity growth of services sub-sectors, which is stronger for EU-8 countries. Finally, we find a positive and significant effect of services liberalization in both finance and infrastructure on labor productivity of downstream manufacturing in several ECA countries.

Our findings suggest a potential for services-driven growth in the ECA region if policy-makers sustain the momentum of productivity growth in services by pursuing further liberalization, removing product market barriers still limiting competition in various sub-sectors, allowing more FDI, and providing the incentives to promote trade in services. Productivity growth in services would also benefit from further penetration of ICT which requires improvements in competition and continued liberalization of the telecommunications sub-sector as well as from skills development. Finally, in order to better assess the impact of policy reforms on the performance of the services sector, policy-markers in ECA countries would benefit from various data collection efforts: (i) sub-sectoral FDI inflows over time, (ii) regulatory reform data for sub-sectors such as wholesale and retail trade, and (iii) firm-level census data for the services sector to capture the entry and exit of firms in sub-sectors undergoing reforms.

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Appendix A

Appendix Table A.1: Sectoral Classification of Services

Sub-sectors in KLEMS database: NACE 2-digit	Sub-Sector Description
40	Electricity, gas, steam and hot water supply (Non-ICT) [High skill]
41	Collection, purification and distribution of water (Non-ICT) [High skill]
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale services of automotive fuel (Non-ICT) [Low skill]
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles (ICT user) [Low skill]
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (ICT user) [Low skill]
55	Hotels and restaurants (Non-ICT) [Low skill]
60	Land transport; transport via pipelines (Non-ICT) [Low skill]
61	Water transport (Non-ICT) [Low skill]
62	Air transport (Non-ICT) [High skill]
63	Supporting and auxiliary transport activities; activities of travel agencies (Non-ICT) [High skill]
64	Post and telecommunications (ICT producer) [High skill]
65	Financial intermediation, except insurance and pension funding (ICT user) [High skill]
66	Insurance and pension funding, except compulsory social security (ICT user) [High skill]
67	Activities auxiliary to financial intermediation (ICT user) [High skill]
70	Real estate activities (Non-ICT) [High skill]
71	Renting of machinery and equipment without operator and of personal and household goods (ICT user) [High skill]
72	Computer and related activities (ICT producer) [High skill]
73	Research and development (ICT user) [High skill]
74a*	Legal, technical, and advertising (ICT user) [High skill]
74b*	Other business activities (Non-ICT) [High skill]

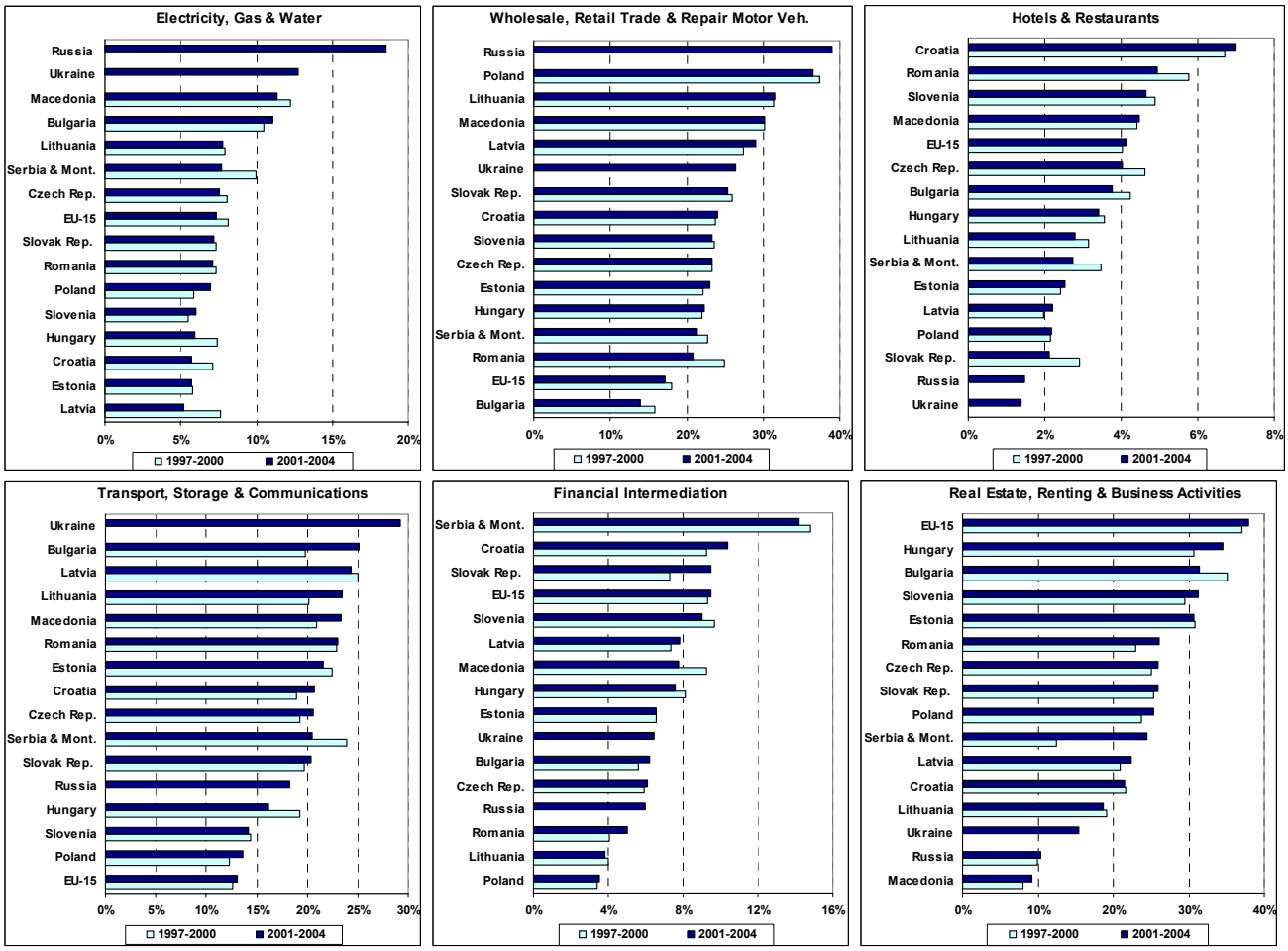
Sub-sectors in WIIW database	Sub-Sector Description
40+41	Electricity, gas, and water
50+51+52	Wholesale, retail, and repair of motor vehicles
55	Hotels and restaurants
60+61+62+63+64	Transport, storage, and communications
65+66+67	Financial intermediation
70+71+72+73+74a+74b	Real estate, renting, and business activities

Notes: * indicates a slight modification from the original NACE 2-digit classification made by the KLEMS database. In the original classification, 74a and 74b are a single category NACE 74 entitled 'Other business activities'. In parenthesis () and [] we show the classification of each sub-sector according to the role of ICT and skills discussed in Section 3.2.

Appendix Table A.2: Data Description and Variable Definitions

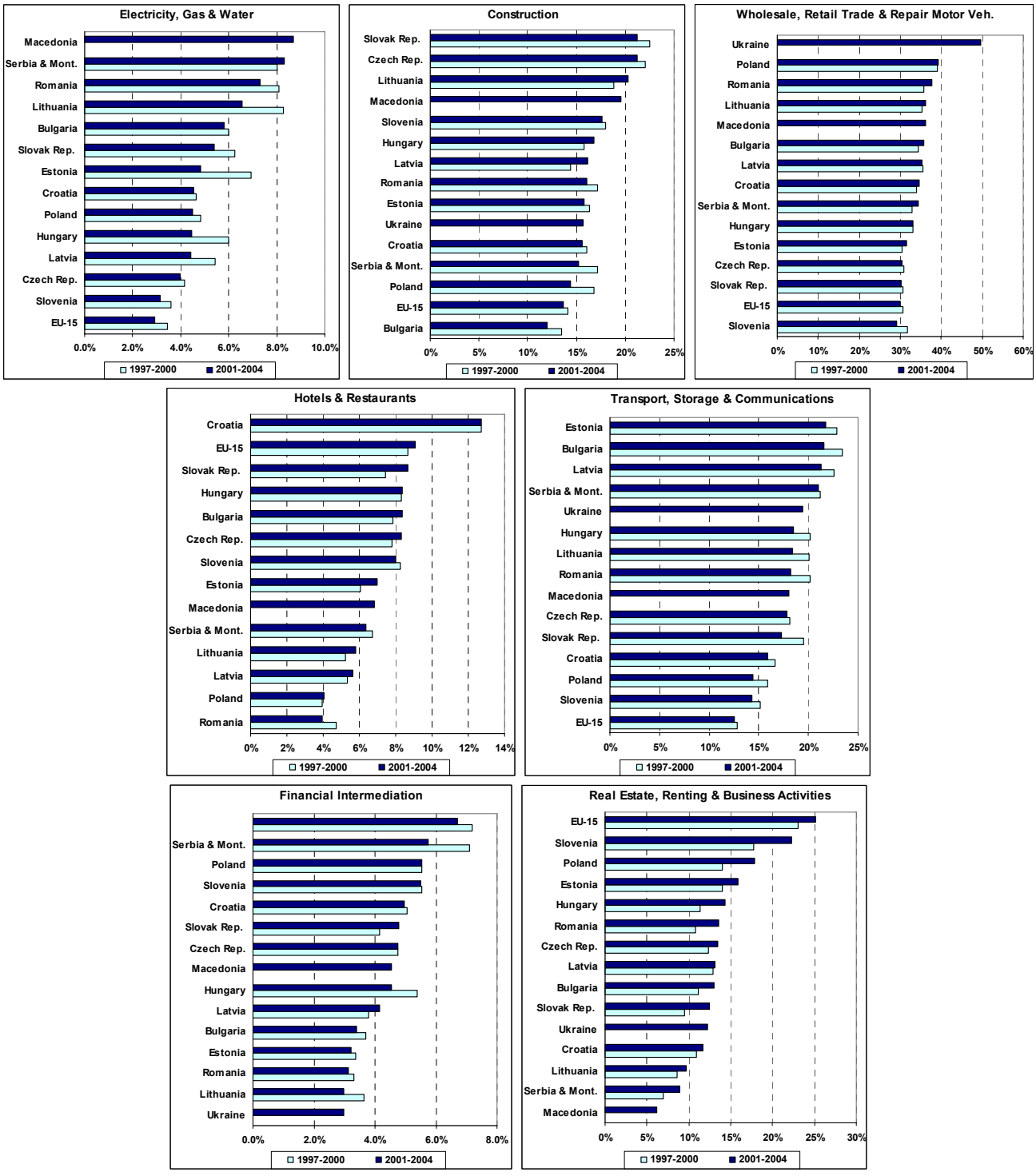
Variable	Description
Value added WIIW database	Gross value added measured at current basic prices expressed in millions of domestic currency for each sub-sector. Coverage: 1997-2004 for Czech Republic, Slovak Republic, Slovenia; 1997-2003 for Hungary, Macedonia, Poland and Serbia and Montenegro; 1997-2002 for Bulgaria, Croatia, and Romania; 2001-2002 for Ukraine; 2002-2004 for Russia.
Employment WIIW database	Total number of employees in thousands for each sub-sector. Coverage: 1997-2004 for Czech Republic, Slovak Republic, Slovenia; 1997-2003 for Hungary, Poland and Serbia and Montenegro; 1997-2002 for Bulgaria, Croatia, and Romania; 2001-2003 for Macedonia; 2001-2002 for Ukraine. No data available for Russia.
GDP deflator	From World Development Indicators. Coverage: 1997-2004 for Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Serbia and Montenegro, Slovak Republic, Slovenia, Ukraine.
Expenditure-based PPP	Relative ratio between average domestic price level and average US price level in 2001 divided by the 2001 exchange rate of domestic currency against USD. Source: World Development Indicators. Coverage: 2001 for Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Slovak Republic, Slovenia, Ukraine. No data available for Serbia and Montenegro.
Value added KLEMS database	Gross value added measured at current basic prices expressed in millions of domestic currency for each sub-sector. Coverage: 1997-2004 for Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia, EU-15 countries. For Latvia, Italy, Ireland data from NACE 40 and 41 is aggregated.
Employment KLEMS database	Total number of employees in thousands for each sub-sector. Coverage: 1997-2004 for Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia, EU-15 countries. For Latvia, Italy, Ireland data from NACE 40 and 41 is aggregated.
Output deflator KLEMS database	Gross output deflator for each sub-sector. Coverage: 1997-2004 for Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia, EU-15 countries. For Latvia, Italy, Ireland data from NACE 40 and 41 is aggregated.
Production-based PPP	Relative ratio between domestic price level and German price level in 1997 for each sub-sector divided by the 1997 exchange rate of domestic currency against euros. Coverage: 1997 for Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia, EU-15 countries. For Latvia, Italy, Ireland data from NACE 40 and 41 is aggregated.
EBRD policy reform index	Index ranging from 0 to 4 reflecting the judgment of the EBRD's Office of the Chief Economist about country-specific progress in policy reform in each sub-sector. Source: EBRD Transition Report 2004. Coverage: 1997-2004 for Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia, Ukraine.
Labor productivity WIIW Industrial Database Eastern Europe	Index of labor productivity in manufacturing sub-sectors relative to the average labor productivity in the country. Coverage: 1997-2004 for Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Slovak Republic, Slovenia.
Input-output tables	All tables are at NACE 2-digit level and cover the input linkages between all sectors in the economy. Czech Republic and Romania I-O tables are for 2002. Bulgaria, Hungary, and Slovenia I-O tables are for 2001. Slovak Republic I-O table is for 2000. Poland I-O table is for 1999. Estonia I-O table is for 1997. Lithuania I-O table is for 1996.

Appendix Figure A.1: Share of Sub-Sectors in Services Value Added



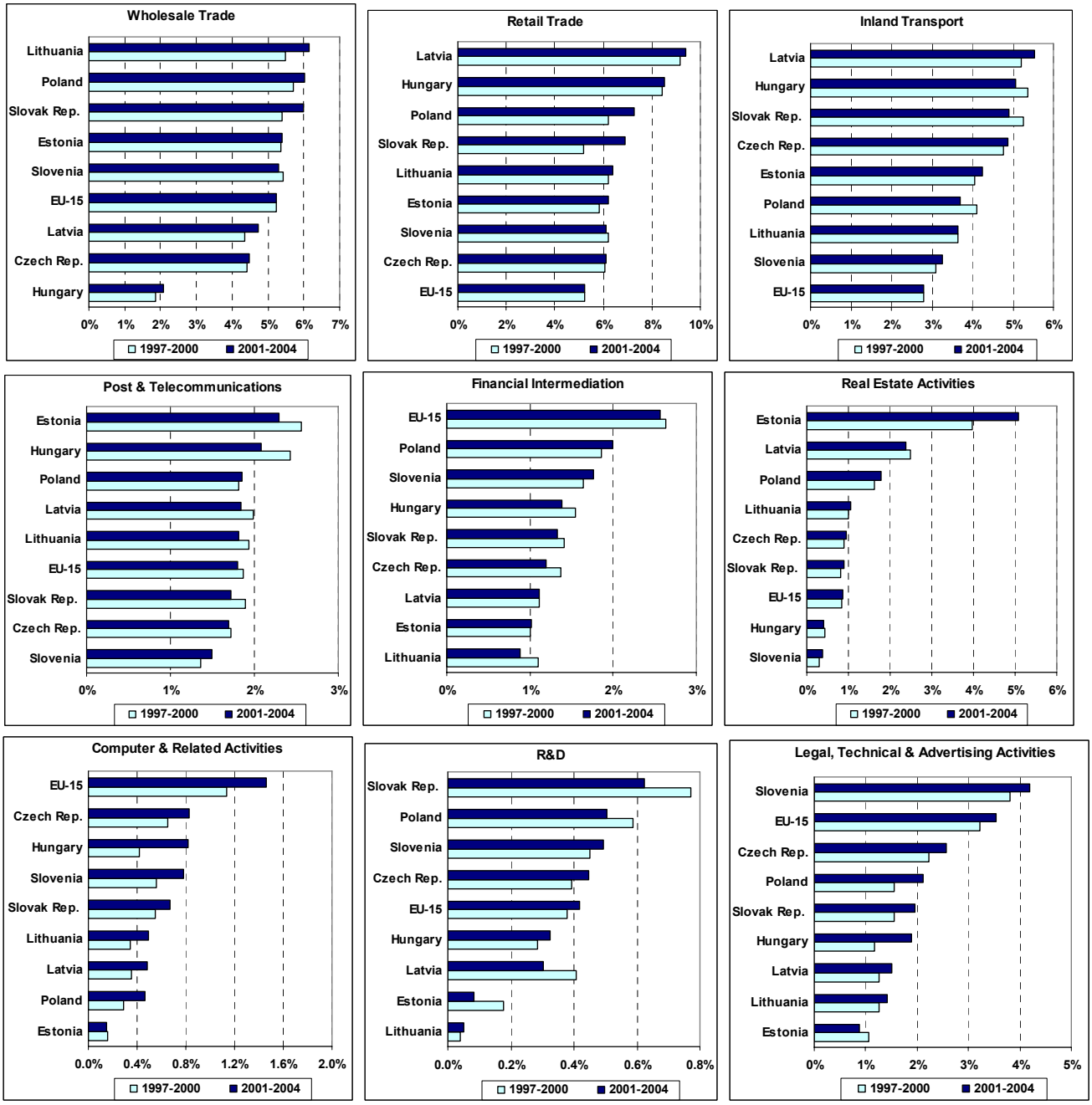
Source: WIIW database 2005 and KLEMS database 2007.

Appendix Figure A.2: Share of Sub-Sectors in Services Employment



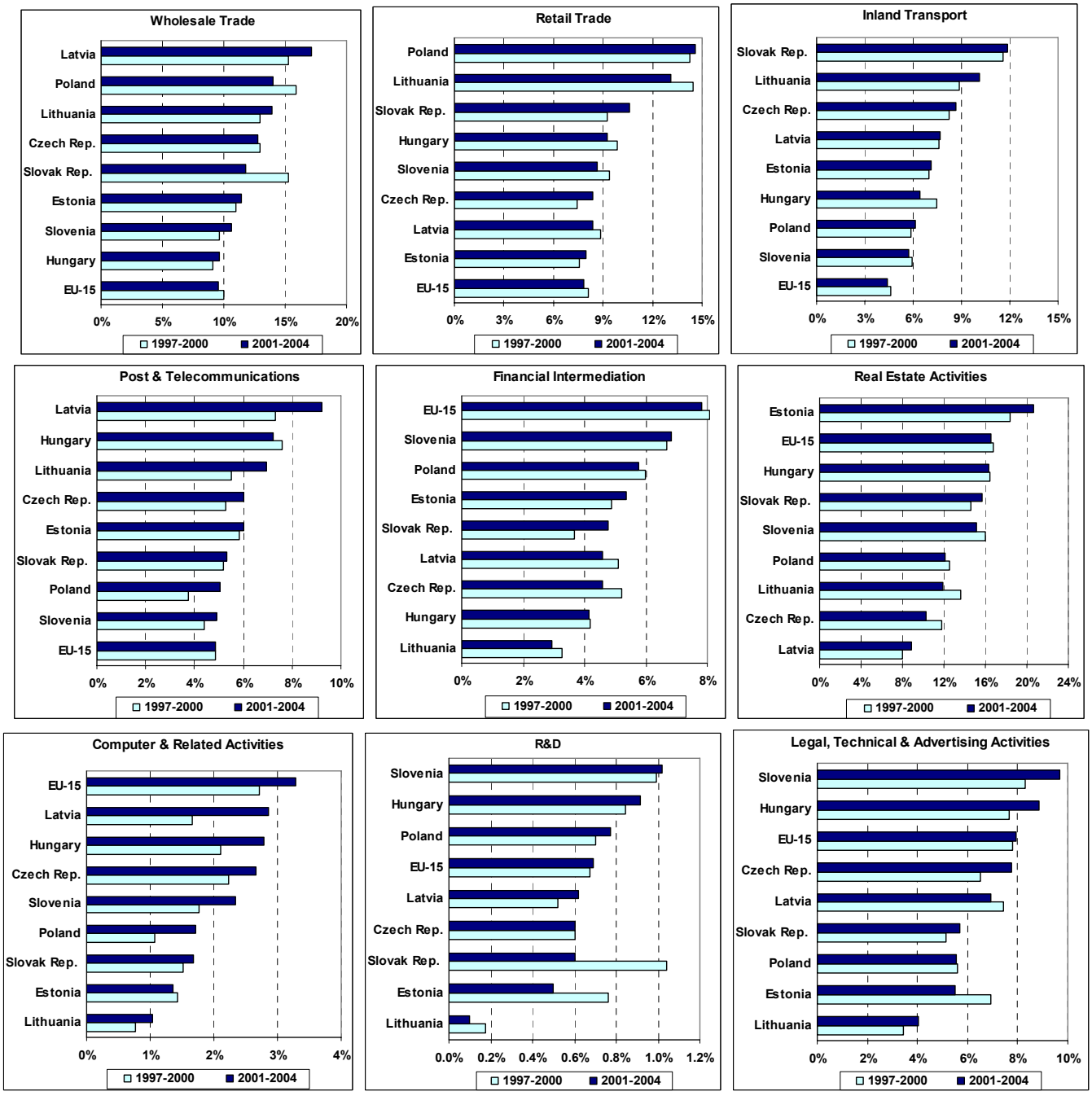
Source: WIIW database 2005 and KLEMS database 2007.

Appendix Figure A.3: Share of Disaggregated Services Sub-Sectors in Total Employment



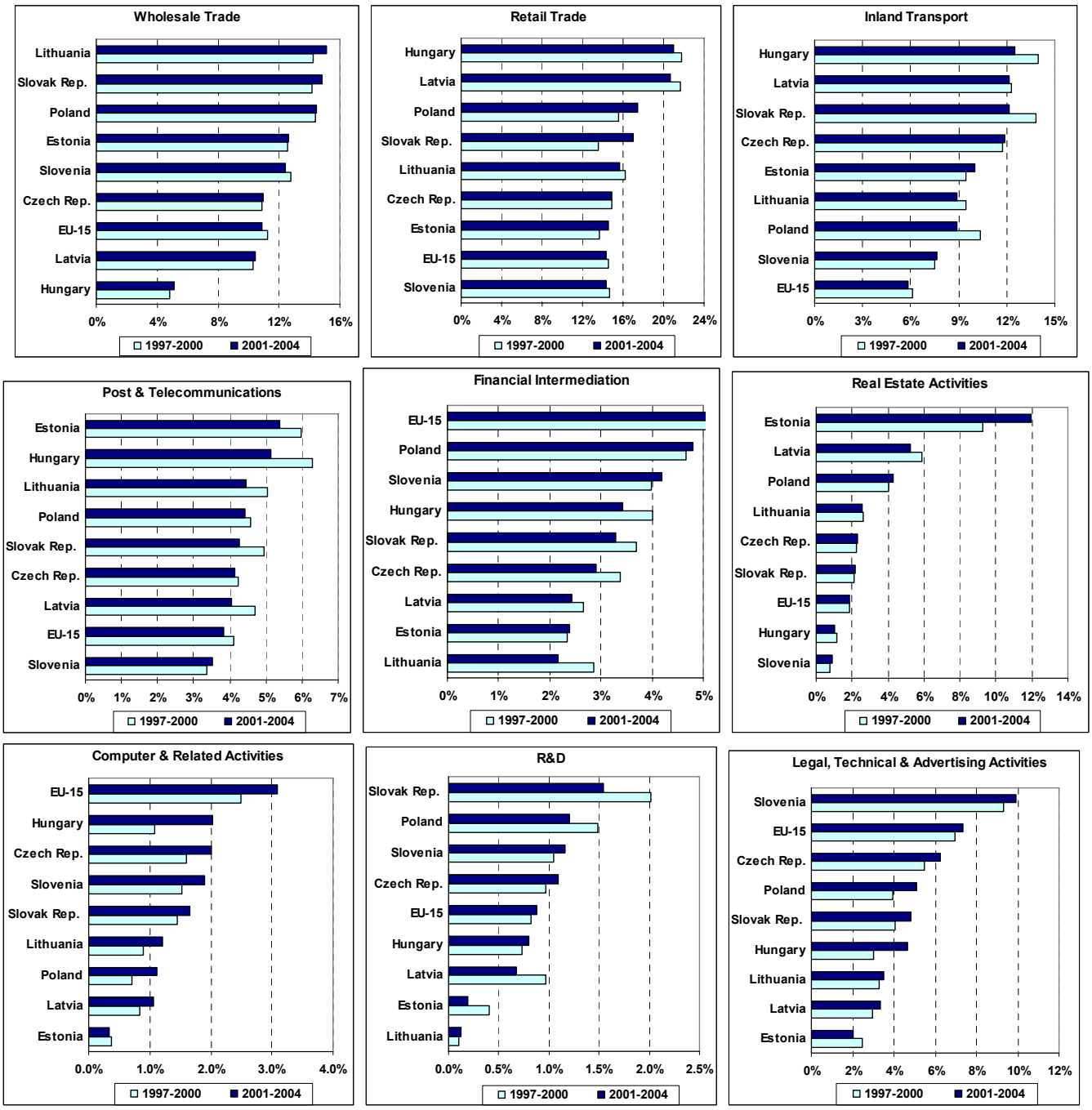
Source: KLEMS database 2007.
Note: In this figure, financial intermediation is NACE 65 category.

Appendix Figure A.4: Share of Disaggregated Services Sub-Sectors in Services Value Added



Source: KLEMS database 2007.
Note: In this figure, financial intermediation is NACE 65 category.

Appendix Figure A.5: Share of Disaggregated Services Sub-Sectors in Services Employment



Source: KLEMS database 2007.
Note: In this figure, financial intermediation is NACE 65 category.

Appendix B: Computing Real Value Added

1. Expenditure-Based PPP Conversion Rates

To transform nominal value added from the WIIW database, we use expenditure-based PPPs in 2001 for ECA country c PPP^{c}_{2001} (relative to the USD) backdated and updated to cover our sample period 1997-2004 using GDP deflators for each ECA country c P^{c}_{t} relative to the United States (US) P^{US}_{t} as follows:

$$PPP^{c}_{t} = \left(\frac{\frac{P^{c}_{t}}{P^{c}_{2001}}}{\frac{P^{US}_{t}}{P^{US}_{2001}}} \right) * PPP^{c}_{2001} \qquad \text{(B1)}$$

Then, we use these PPP conversion rates to transform gross nominal value added in country c sub-sector j and year t expressed in local currency units Y^{c}_{jt} into real value added in 2001 PPP USD: $RY^{c}_{jt} = Y^{c}_{jt} / PPP^{c}_{t}$.

2. Production-Based PPP Conversion Rates

To transform nominal value added from the KLEMS database, we use production-based sub-sector-specific PPPs in 1997 for ECA country c PPP^{c}_{j2001} (relative to the Euro) backdated and updated to cover our sample period 1997-2004 using sub-sector specific output price deflators for each ECA country c P^{c}_{jt} relative to Germany P^{G}_{jt} as follows:

$$\overline{PPP}^{c}_{jt} = \left(\frac{\frac{P^{c}_{jt}}{P^{c}_{j1997}}}{\frac{P^{G}_{jt}}{P^{US}_{j1997}}} \right) * PPP^{c}_{j1997} \qquad \text{(B2)}$$

Then, we use these PPP conversion rates to transform gross nominal value added in country c sub-sector j and year t expressed in local currency units Y^{c}_{jt} into real value added in 1997 PPP Euros: $\overline{RY}^{c}_{jt} = Y^{c}_{jt} / \overline{PPP}^{c}_{jt}$.

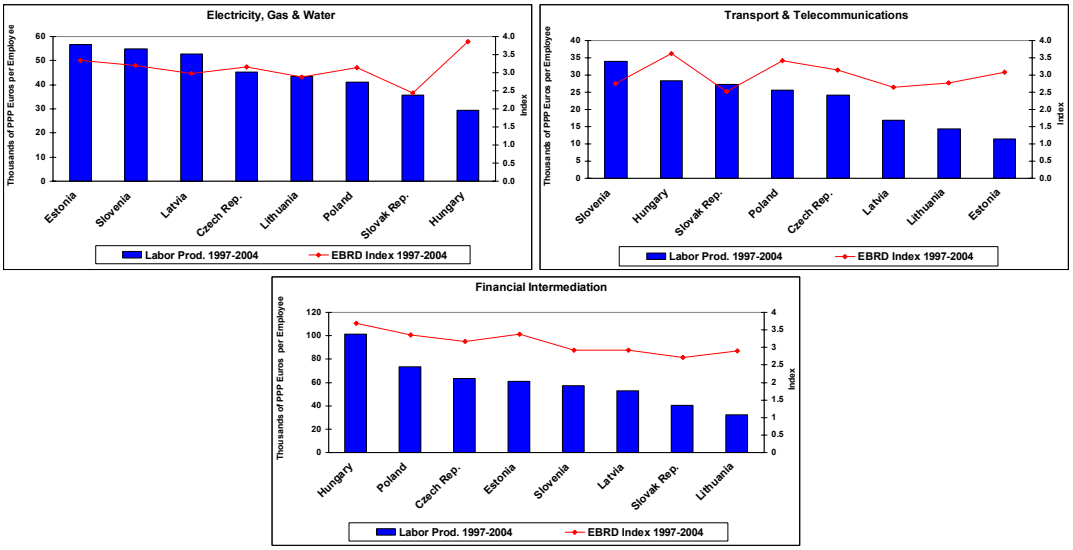
Appendix Table B.1: Growth Rates of Expenditure-Based PPP and Production-Based PPP Conversion Factors

	1998	1999	2000	2001	2002	2003	2004
Czech Republic							
Expend.-based PPP conv. rate	*10.0%*	*1.3%*	*-0.8%*	*2.4%*	*1.1%*	*0.7%*	*0.4%*
Prod.-based PPP conv. rate - retail trade	0.8%	0.2%	10.2%	6.4%	14.9%	-5.0%	-0.1%
Prod.-based PPP conv. rate - inland transport	6.5%	4.1%	1.6%	-5.5%	-2.4%	-1.5%	6.7%
Prod.-based PPP conv. rate - telecommunications	5.9%	16.8%	9.9%	3.7%	0.2%	0.6%	0.0%
Prod.-based PPP conv. rate - financial intermediation	14.0%	-5.0%	19.3%	1.6%	3.0%	0.1%	0.9%
Prod.-based PPP conv. rate - real estate	9.6%	2.8%	1.2%	1.4%	1.4%	2.4%	1.6%
Prod.-based PPP conv. rate - computer and related act.	11.3%	6.6%	6.6%	6.5%	5.7%	1.8%	3.4%
Hungary							
Expend.-based PPP conv. rate	*11.4%*	*6.9%*	*6.7%*	*5.5%*	*7.9%*	*4.7%*	*1.9%*
Prod.-based PPP conv. rate - retail trade	8.7%	7.7%	3.8%	11.2%	3.6%	2.0%	6.5%
Prod.-based PPP conv. rate - inland transport	11.5%	7.6%	5.0%	2.0%	0.1%	0.3%	11.3%
Prod.-based PPP conv. rate - telecommunications	10.6%	23.9%	8.5%	8.0%	2.7%	2.1%	0.0%
Prod.-based PPP conv. rate - financial intermediation	19.1%	-0.9%	40.1%	-9.8%	0.0%	-5.1%	-11.2%
Prod.-based PPP conv. rate - real estate	14.7%	12.6%	8.2%	8.9%	2.8%	6.0%	4.8%
Prod.-based PPP conv. rate - computer and related act.	6.7%	9.7%	7.7%	5.6%	6.2%	4.0%	3.9%
Poland							
Expend.-based PPP conv. rate	*10.3%*	*4.8%*	*4.4%*	*1.6%*	*-0.3%*	*-1.2%*	*0.2%*
Prod.-based PPP conv. rate - retail trade	11.3%	4.2%	3.9%	4.8%	0.1%	0.0%	5.3%
Prod.-based PPP conv. rate - inland transport	8.7%	7.7%	5.8%	0.3%	-0.2%	-2.4%	5.4%
Prod.-based PPP conv. rate - telecommunications	10.9%	19.3%	13.6%	8.5%	2.5%	2.6%	2.4%
Prod.-based PPP conv. rate - financial intermediation	4.1%	-4.5%	37.2%	-7.7%	-6.5%	-4.6%	1.2%
Prod.-based PPP conv. rate - real estate	23.7%	9.2%	10.7%	6.9%	1.6%	1.3%	2.3%
Prod.-based PPP conv. rate - computer and related act.	24.2%	12.8%	11.7%	9.0%	3.7%	1.4%	1.8%
Slovak Republic							
Expend.-based PPP conv. rate	*4.1%*	*4.9%*	*6.1%*	*1.7%*	*2.3%*	*2.8%*	*1.9%*
Prod.-based PPP conv. rate - retail trade	-1.7%	8.5%	1.2%	3.6%	6.4%	19.2%	9.6%
Prod.-based PPP conv. rate - inland transport	-3.9%	11.7%	0.9%	6.2%	1.2%	4.0%	15.5%
Prod.-based PPP conv. rate - telecommunications	10.8%	25.2%	22.0%	12.0%	8.2%	8.8%	15.2%
Prod.-based PPP conv. rate - financial intermediation	19.8%	-16.2%	38.9%	7.5%	8.0%	-0.2%	16.2%
Prod.-based PPP conv. rate - real estate	5.9%	12.4%	13.8%	14.8%	13.9%	4.2%	10.1%
Prod.-based PPP conv. rate - computer and related act.	18.2%	6.9%	14.6%	16.2%	10.7%	8.7%	14.7%
Slovenia							
Expend.-based PPP conv. rate	*6.4%*	*4.4%*	*3.4%*	*6.5%*	*6.3%*	*3.6%*	*0.4%*
Prod.-based PPP conv. rate - retail trade	2.7%	0.5%	0.3%	9.2%	13.6%	6.4%	4.8%
Prod.-based PPP conv. rate - inland transport	4.0%	6.2%	7.7%	-1.5%	6.8%	4.0%	11.9%
Prod.-based PPP conv. rate - telecommunications	11.7%	19.6%	9.7%	14.1%	6.2%	7.8%	5.5%
Prod.-based PPP conv. rate - financial intermediation	-14.3%	1.3%	37.5%	-7.4%	-4.9%	-3.3%	-5.1%
Prod.-based PPP conv. rate - real estate	10.2%	6.5%	10.7%	7.3%	5.5%	5.3%	4.7%
Prod.-based PPP conv. rate - computer and related act.	10.2%	7.9%	3.4%	14.0%	1.5%	5.4%	5.2%

Source: World Development Indicators and WIIW Database.
Notes: Growth rates of expenditure-based conversion rates are given by the growth in Equation (B1). Growth rates of production-based conversion rates are given by the growth in Equation (B2).

Appendix C

Appendix Figure C.1: Policy Reform and KLEMS Labor Productivity – Averaging NACE 2-digit Sub-Sectors



Source: KLEMS database 2007 and EBRD Transition Report.
Notes: Electricity, Gas, and Water is the average of NACE 40 and 41. Transport and Telecommunications is the average of NACE 60 and 64. Financial intermediation is the average of NACE 65, 66, and 67.